R-COMP-A-64-I

COMPUTATION LABORATORY

THE ALPHA SYSTEM

A PROGRESS REPORT OF PHASE I OF A PLAN TO AUTOMATE THE OPERATION OF THE REDSTONE SCIENTIFIC INFORMATION CENTER

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ABSTRACT

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In March, 1963, the Redstone Scientific Information Center requested, through Project Order 37160100-99-70020, the Marshall Space Flight Center to perform a study designed to automate the operation of RSIC. The task was accepted by the Projects & Industry Applications Division of MSFC's Computation Laboratory. It was subsequently assigned to Engineering & Management Computations, a component of the General Electric Company.

This report documents Phase I of the study resulting from the project order.

The product of the study is the design of the ALPHA I System. Among the items discussed in this report are the organization of the study project, project goals, design criteria, and the ALPHA I system concept and operating information. The system is then described in more detail for books and documents, and a plan for implementation is presented.

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of a Plan to Automate the Operation of the
Redstone Scientific Information Center

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PROJECT & INDUSTRY APPLICATIONS DIVISION

COMPUTATION LABORATORY

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LIST OF ILLUSTRATIONS

Organizations Concerned with
the Administration of RSIC
or the Performance of
the RSIC Automation System Study

Joint RSIC Board

Representing USAMICOM

J. J. Fagan
J. F. Rush
J. P. Hallowes
Dr. B. Steverding

Representing MSFC

V. C. Sorenson
Dr. H. J. Sterling
Dr. R. D. Shelton
Dr. K. J. Pschera

U. S. Army Organizations

Maj. Gen. John G. Zierdt, Commanding General, U. S. Army Missile Command
Col. D. F. Shepherd, Director, R&D Directorate
Fred E. Croxton, Director, RSIC

Col. Thomas Cooke, Commander, U. S. Army Missile Support Command
Joseph B. Bennett, Chief, Computation Center
William C. Dunlap, Chief, Commercial Programming Branch

NASA Organizations

Dr. Wernher von Braun, Director, George C. Marshall Space Flight Center
Dr. Helmut Hoelzer, Director, Computation Laboratory
William H. Fortenberry, Chief, Projects & Industry Applications Division

General Electric Company (Contract NAS8-35)

H. R. Wrage, Manager, Huntsville Operation
C. S. Chamberlin, Manager, Engineering & Management Computations

W. J. Wilson, Project Leader
Miss E. F. Miller, Senior Systems Analyst
J. B. Burger, Systems Analyst
I. Hirsch, Programmer

I. INTRODUCTION

A. PURPOSE

This report has been prepared to document Phase I of a study of the problem of automating the operation of the Redstone Scientific Information Center (RSIC). The product of this study is the design of the ALPHA I System.

The report is intended to serve two general purposes. It presents to RSIC the results of work performed by the General Electric Company during a limited period as a contractor under technical supervision of the Computation Laboratory, George C. Marshall Space Flight Center (MSFC). It also reports for wider distribution the current status of a continuing RSIC program of system development in the fields of document control and information manipulation and retrieval.

B. AUTHORIZATION

The Redstone Scientific Information Center requested MSFC to perform this study, when it issued Project Order 37160100-99-70020, on 21 March 1963.

The task was accepted by the Projects & Industry Applications Division of MSFC's Computation Laboratory. The project order was subsequently assigned for performance to Engineering & Management Computations (E&MC), a component of the Huntsville Operation, Computer Department, General Electric Company.

C. ORGANIZATION OF STUDY PROJECT

The contractor formed a project group, consisting of Messrs. W. J. Wilson (Project Leader), Miss E. F. Miller, J. B. Burger, and I. Hirsch and operating under general supervision of Mr. C. S. Chamberlin, Manager, E&MC. The contractor also supplied the services of Mr. C. Dake Gull, a consulting analyst with extensive training and experience in the field of library science. During a visit at the outset, Mr. Gull provided the project group with general orientation and suggestions for investigation of the existing manual operations of the Redstone Scientific Information Center.

Technical supervision of contractor performance was the responsibility of Mr. W. H. Fortenberry, Chief, Projects & Industry Applications Division, representing MSFC.

The conduct of the study involved close cooperation of the contractor project group with the Redstone Scientific Information Center and the Computation Center, both agencies of USAMICOM, the U.S. Army Missile Command. These agencies were represented by Mr. F. E. Croxton, Director, RSIC, and Mr. W. C. Dunlap, Chief, Commercial Branch, Computation Center. In addition to continuing guidance by the Director, essential information was provided by various members of RSIC staff. Members of both agencies participated actively in the project.

D. WORK PERFORMED

The study was commenced by investigating practical operations and purposes, analyzing what actually was being done in the library. Detailed flow charts were developed for the book and the document activities (each flow chart covers about sixty square feet).

The accuracy and completeness of the charts were verified through meetings with RSIC officials, librarians, and clerks directly involved in the activities. A variety of revisions were made, some to correct errors and others to make interim improvements in existing manual procedures. In the latter case, every effort was made to insure that the changes contributed to the ultimate goal of automation.

The investigation phase of the study also covered the question of service goals and operational requirements; these were formulated in general terms, independent of manual methods currently employed. The investigation phase was concluded with the determination of design criteria. Some were formulated from the standpoint of normal information processing technology, others from the standpoint of library science, and still others from the standpoint of particular circumstances of RSIC.

The next major milestone was the conception and design of a system integrating all those functions found to be amenable to immediate computer application. Detailed specifications defining the automatic information processing, retrieval, and control system, were prepared.

The final milestone was development of a logical time-phased plan of implementation.

Implementation is currently in process. It should be pointed out in this connection that the original plan provided that the contractor would confine his efforts to analysis and design of the over-all system. USAMICOM Computation Center programmers would perform detailed design, programming, and installation. As the study progressed, however, this plan was changed. The contractor was requested to provide the Computation Center with detailed documentation containing all information required to program each run. On the other hand, detailed design of the periodical control subsystem was excluded from the contractor's scope of work. All work on the periodicals subsystem was performed by the USAMICOM Computation Center.

E. SCOPE OF REPORT

Automation development by RSIC is a program of considerable scope and duration. The present report shows progress on Phase I of this program. It is limited to accomplishments by the contractor during the six months ended in November, 1963, when MSFC support was concluded and terminated.

The report is supported by additional documentation, not prepared for general distribution because of the detail involved, limited interest, or other problems such as the unwieldy size of the flow charts previously mentioned. These addenda individually represent subsystems or modules and are defined in the implementation plan covered in Section VI of this report.

The remainder of the report describes the general system requirements developed during the investigation phase of the study, and explains the first-generation plan to fulfill those requirements. Sections on books and documents follow, including discussions of activities of the three sections of the RSIC Library Branch: Operations (ordering, receiving, accountability, and cataloging) Readers Service (circulation, recall, and reproduction), and Document (cataloging, referencing, circulation, and statistics). The periodicals subsystem is excluded since it is USAMICOM Computation Center responsibility.

The substance of the report was prepared by the analysts assigned to the contractor project group. The report was edited and produced by E&MC, General Electric Company. It has been approved and released through the Projects & Industry Applications Division, Computation Laboratory, MSFC.

II. GENERAL SYSTEM REQUIREMENTS

A. REDSTONE SCIENTIFIC INFORMATION CENTER

RSIC is a part of the Research & Development Directorate of the U. S. Army Missile Command located at Redstone Arsenal, Alabama.

It serves the scientists and engineers of USAMICOM, MSFC, and their contractors. RSIC was established by agreement between the Army and NASA, and operates under the guidance and advice of a joint board of four representatives from USAMICOM and four from MSFC. Both organizations in turn contribute to the support of RSIC. This arrangement, which eliminates duplication and results in more effective service, appears to be unique among libraries in the government.

The nation's largest concentration of scientists and engineers specializing in a unified group of scientific disciplines probably is located in Huntsville. The program did not develop near established seats of learning or near another major technological center. The information resources necessary to support the local Army and NASA programs, therefore, had to be developed "from scratch".

Requirements for information service imposed upon RSIC have increased over 50% during the last year. The potential patron group is approximately 20,000 employees, including 6,000 scientific and engineering professionals. During the past two years, RSIC has grown tremendously. Currently its holdings include 70,000 books, 300,000 documents, and a journal subscription list of over 2,000 titles. It is undoubtedly the largest information center for aerospace technology in the world.

RSIC is divided into four branches: Information Program, Research, Library, and Translation. The Library Branch is subdivided into three sections: Operations, Readers Service, and Document. This organization is illustrated by Figure 1.

RSIC has five major missions. It serves as a principal source of research literature, obtaining and maintaining exhaustive holdings in those scientific and technical disciplines for which USAMICOM and MSFC have missions. Examples include missiles, rockets, propellant, rocket motors, chemistry,

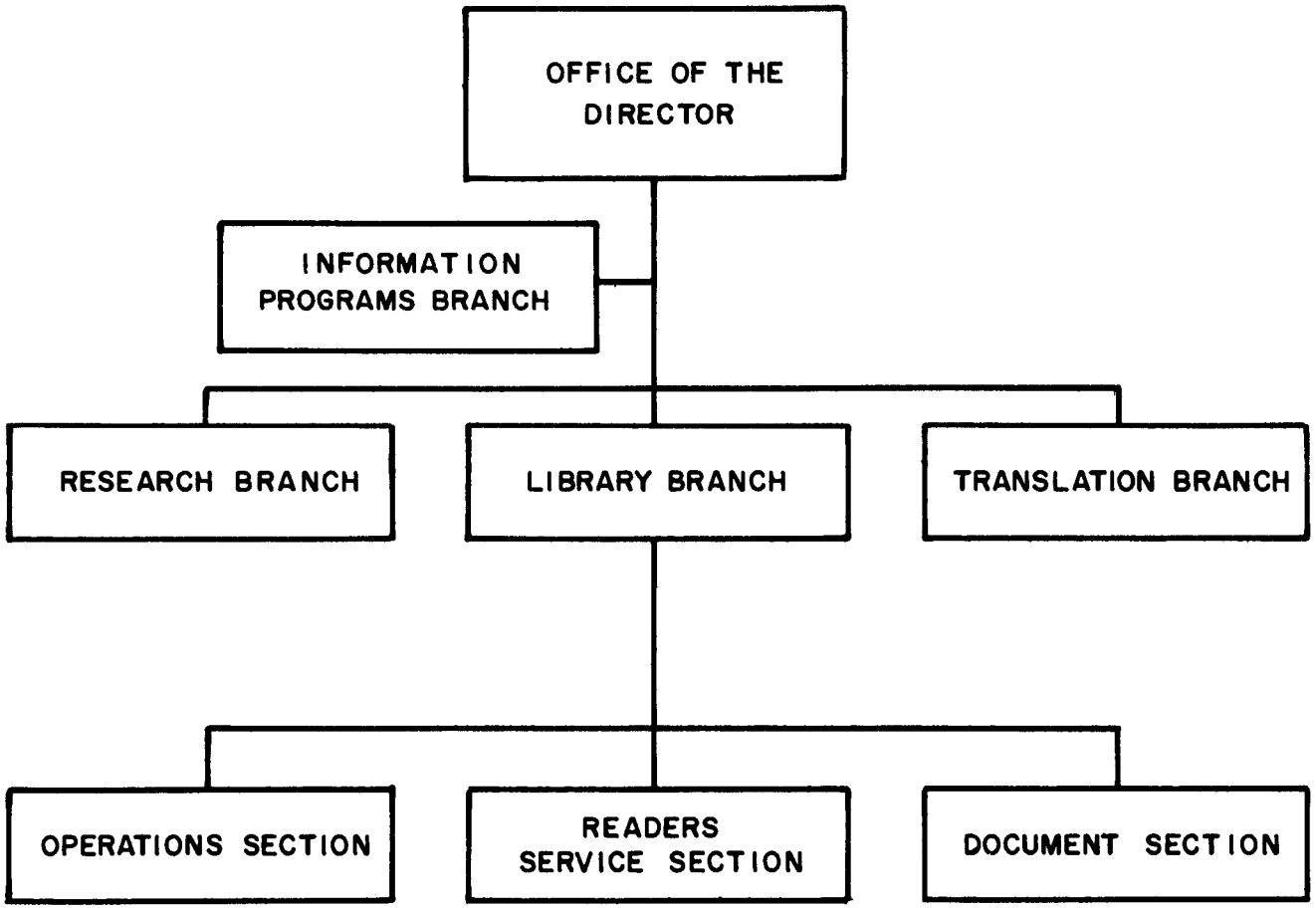

Figure 1. RSIC Organization Chart.

electronic engineering, mathematics, physics, metallurgy, meteorology, aerophysics, mechanics, and related fields. It thus provides complete scientific service for these two organizations and their contractors. It also maintains liaison with universities, research institutes, and the like engaged in related R&D activities. RSIC participates in an information interchange program through which the bibliographical sources of the nation are made available at Redstone Arsenal.

Of immediate concern to the present study, the RSIC mission includes the planning and conduct of investigations, feasibility studies, and tests related to the development of modern information manipulation methods leading to improved information retrieval and technical communication techniques.

B. INITIAL PROJECT GOALS (PROJECT ORDER 3/160100-99-70020)

The objective of the projected study was to design, develop, and prepare for installation an integrated and automatic information processing, retrieval, and control system for RSIC. The work to be performed would define the requirements of the system, develop an automation plan, and outline a sequence of implementation. RSIC and the USAMICOM Computation Center were to program, install, and operate the final system.

The system developed would encompass descriptive, subject, and inventory control aspects for all types of information processed and controlled by RSIC. The system engineers performing this study would utilize their experience related to information processing and retrieval in scientific and engineering fields in addition to their knowledge of EAM and ADP capabilities to devise a system having built-in flexibility for expansion and interconnection with other automated information centers. The system would be of the external-index type, would take advantage of advances in information processing and retrieval already made, and would utilize insofar as practical ADP equipment already available to the Computation Center. In any event, only equipment commercially available was to be specified.

A final report covering input requirements, reference file data, output report requirements, program interrelationships, flow charts, general procedure outlines, and other significant data was to be submitted. Brief progress reports were expected frequently throughout the study. A general over-all outline of the system was to be submitted within 90 days.

C. TECHNICAL DESIGN CRITERIA

While primary emphasis in Phase I was upon solution of the housekeeping problems of RSIC, it was believed that the system design should be applicable to the total RSIC problem, including a basis for solution of its information manipulation and retrieval functions. In pursuing this total systems approach, it was necessary to apply principles representing a variety of disciplines.

The principles selected and used as design criteria in synthesizing the concept of the ALPHA System were formulated in two sections - those applying to the system and those resulting from RSIC environment. For the ALPHA System, the environment was considered the set of all objects outside of the system, a change in the attributes of which affect the system and whose attributes are changed by the system. The principles selected and used as criteria are listed below.

1. Information Processing and System Principles

1. The computer will be used when the basis for decisions can be defined in terms of logic tables, reference tables, or inequalities, and when the action taken can be performed or expressed automatically by the computer and its peripheral equipment.

2. Operations performed and data included will be simplified and minimized. As many operations as possible will be included in a kind of closed-loop system so that its interrelated component functions are planned, tested, and proved compatible with the system as a whole to insure economic and efficient operation of the entire system.

3. Original input data will be introduced into the system at the earliest possible point in the process. For books, this would normally be at the time of ordering; for documents, at the time of receipt.

4. The duplication of data, processing, and transcription will be minimized through consolidation of files, integration of related functions, and use of feedback loops. For example, a pre-punched card would be generated at the time of an order to serve later for the receiving transaction. When the item is received, it would be necessary to add only the quantity received and other data specific to the action of receipt.

5. The computer will be used to perform checks on the validity and consistency of data entered into the system.

6. A "hopper" concept will be used for acquisition of input data whenever appropriate. This technique provides that transactions of differing types and priorities may be "thrown in the hopper" for the computer to determine what transactions affect which records and in what order and to what extent. This procedure simplifies the rules and effort imposed on library personnel operating externally to the system.

7. The system will be open-ended and capable of expansion. It will be easy to modify, change, and extend.

8. The system will provide for incorporation of adaptable programmed subsystems, thesauri, authority lists, and planned and existing machine readable files, such as NASA STARS tapes, DDC tapes, AEC tapes, and Library of Congress information.

8. The system will continue to supply, and in fact augment, the external lists and catalogs that must be available for inspection by library personnel in the discharge of their duties. Ultimately much of this information may be stored in a data bank with random access and remote inquiry capability, reducing dependence on manual operations.

2. Principles Attributed to Environment

1. Function of RSIC. The Redstone Scientific Information Center is a communication link between those possessing information and those needing information of a particular kind. At the same time, the role of RSIC is not passive; a one-to-one correspondence seldom exists between available information and information needed. RSIC as a communication link must process knowledge purposefully and maximize its utility by promoting its own use. At the same time, the latter effort must be controlled to insure that demand is not stimulated beyond capacity.

2. Novelty of Problem. If physical objects like books and documents are considered to be the "elements" of information, the RSIC problem is similar to those solved in other fields by conventional data processing applications - for examples, materials inventory; procurement ordering, receiving, and inspection; production control; and accounting. When the elements of information are considered in a more functional sense, a great deal of development planning is needed. Even after searches of the literature, visits to other automated activities, and consultation with experts, very little experience was found to be available regarding the design and development of a fully-integrated system for automation of scientific information activities such as RSIC.

3. Structure of Problem. For Phase I purposes, the traditional distinctions according to which scientific information center operations are organized can be effectively used. The significant differences among books, periodicals, and documents may be handled by separate routines, still permitting integration of common operations and requirements.

4. Standards of Performance. The nature of the missions of the organizations supported by RSIC requires rather high standards of performance. These standards include fast reaction time, validity of response, and reliability of response. The response must be valid in the sense that it is comprehensive, while at the same time being appropriate and pointed toward the need. The response must be reliable in the sense that it must not incorrectly represent the holdings available.

5. Stability. The holdings of RSIC are still being developed and expanded. The workload is characterized by large volume and varied content. The need for service is growing at a very fast rate and the character of the need is subject to change as missions and the state of the art evolve.

6. Planning Problem. To have information on tap when needed, the need must have been anticipated in advance to allow for procurement lead time. Present knowledge of requirements must be estimated partly on an a priori basis. Past usage is distorted because holdings were incomplete and operational capacity was limited. Although the fields of knowledge stocked by RSIC are limited, those fields must be stocked past current margins. Unlikely information and the latest information, not just traditional or classic works, may be needed. Provision of information to RSIC management to assist in the forecast of requirements and in the knowing, finding, and getting of items that should be stocked is a fundamental problem.

7. Peculiar Sequencing Requirements. Contemporary data processing equipment incorporates fixed collating rules, i.e., a file of magnetic tape records is ordered (sorted) automatically on designated fields in a fixed order. This order is generally acceptable to business applications, but it does not suffice for the arrangement

of a file, for example, by Library of Congress classification. Whereas a definite order may be achieved, it is not the order normally accorded to such a file by library rules. To circumvent this problem, it was necessary to adopt a "free form" procedure devised by the USAMICOM Computation Center programmers for call numbers, which permitted the ordering of Library of Congress classifications in the expected library order without sacrificed extra data positions.

8. Type Fonts. The relatively meager type fonts available on standard computer printers, while acceptable to normal business applications, are inadequate if the production of printed catalogs having some semblance of the traditional forms is anticipated. Most commercial data processing equipment can handle no more than 64 discrete characters, both internally and on tape. Many printers do not provide for the production of all 64 characters available. It is this factor, rather than the printing devices themselves, that ultimately limits the number of characters available.

9. Standard Data Representation. The simple correlation by a person of the abbreviations - Am. News and Amer. News - as being "identical" is impractical on a computer. Furthermore, the generalization of such an ability for all such cases is a profound programming problem. For sorting or summarization of data on a computer, it is imperative that such "identical" fields of information be truly identical. While it is not outside the bounds of practicality to operate in such a manner on a single control field within a record, this procedure cannot be applied efficiently to any control field that varies in its representation. For a computer, it might be said that a rose by any other

name is certainly no longer a rose. An even more rigorous adherence to authority lists and rules is therefore indicated. The computer can be efficiently utilized to detect deviations from authority rules and to insure adherence to the rules.

This problem is seen in serial titles, author names, vendor designations, and in fact, throughout the entire library operation. A minor problem in a manual operation, it is a formidable problem for a machine lacking the ability for true cerebration.

10. Large Records and Field Representation. For a fully automated information center, it is necessary to create and maintain on magnetic tape lengthy records, such as a complete catalog card entries or entire abstracts. Presumably, the ability to change designated fields of information within such records is required from time to time - barring the total replacement of the record by a complete "corrected" version. Many records have no discernable fields and others have thousands. Field definition is normally accomplished by positional relationships, i.e., the first group of characters of a record is its call number, the next is the title, and so on. In those instances, however, where many fields may be absent or present in a given record, positionally defined identity of field elements is not a good method, and recourse is usually made to field designators where individual fields are preceded by unique codes indicating the type of information to be found. For the Library of Congress card, 1,000 unique codes would have to be constructed to identify all possible component fields. Records so identified cannot be sorted without special pre-sorting computer runs, which select the designated control field and place it in a fixed position.

11. Physical Problems with Large Records. If large records are introduced to a computer via punched cards, allocation of a portion of each card must be made to common identifying information and another portion to an indication of the order of the card with respect to other members in the set. Thus, a large single string of contiguous information may be split among several cards, and extraneous information is required because of this. Likewise, if punched paper tape is used for such records, a variety of limitations are encountered. A good method for pickup of large records of data is not readily available for immediate purposes.

III. ALPHA I SYSTEM

A. CONCEPT

ALPHA is a plan for the integrated performance of all functions of an information center that are presently amenable to automation. In many respects, it is a synthesis of existing techniques and procedures derived from many sources and differs from most contemporary efforts only in scope. In addition to the usual benefits that accrue from automation, such as economy, timeliness, and increased accuracy, it is intended that the trained librarian will be freed from the many clerical tasks which claim such a disproportionate share of her time. Related to this is the need to improve quality of service while accommodating an increasing demand, and to do these things more by means of increased productivity than by increased manpower.

The development of ALPHA I was based on a conception of RSIC library-type operations and information retrieval activities as parts of an integral whole. Analysis revealed that the "housekeeping" problem is by no means insignificant, and led to the conclusion that no effective solution of the information retrieval problem is possible in the absence of unified automation of the housekeeping foundation.

Application of established techniques, rather than performance of basic research, was the desired approach to incorporation in ALPHA I of capabilities for making information available for immediate use wherever needed and for retrospective searching in answer to requests for information. ALPHA I includes one innovation for the latter purpose, making possible the processing of any number of search questions against an inverted descriptor file of RSIC holdings. This procedure is called the Miller search algorithm.

The analysis revealed that bibliographic items in RSIC tend to segment themselves into three broad categories: books, documents, and periodicals. Valid reasons for this fragmentation include security requirements, physical differences in the media themselves, and the peculiar handling requirements of the three classes of bibliographic items. For example, periodicals must be circulated and later bound, and documents have stringent requirements for security "need to know". Still, there is a large measure of commonality among these categories; each must

be ordered, received, indexed in some manner, and made available to the customer or patron.

In keeping with the concept of a single integrated system, every reasonable effort was expended in the formulation of ALPHA to develop procedural techniques for handling the various bibliographic entities (books, documents, and periodicals) in the same manner. Whenever possible, data elements and formats were made similar or identical. Yet caution was exercised to prevent attainment of a spurious compatibility, that would exist for example if "need to know" data were appended to book records where not needed.

The groundwork has been laid in ALPHA for future generations of systems, each evolving logically from its predecessor with each future step in evolution to be dictated by experience and changing requirements.

The name given this system is ALPHA, partly because of the connotation of "first" and partly as an acronym for Automated Literature Processing, Handling, and Analysis System.

B. OPERATING INFORMATION

One characteristic of most manual library systems is the high redundancy of operational and control information existing in whole and in part. A factor contingent on this characteristic is the required multiple transcription of the information as it flows from person to person and from office to office.

It was seen immediately that automation of the housekeeping functions of RSIC would result in a significant reduction of redundancy through the consolidation of scattered information into unique master files from which could be produced various printed lists of information required by library personnel. With the elimination of redundant files, the transcription of common information is correspondingly reduced.

Analysis revealed that the kinds of housekeeping and administrative information required in the operation of an information center can be classified broadly into two categories: bibliographic and patron.

In its broadest sense, the scope of bibliographic information includes all qualifying information relating to items such as books, documents, and periodicals. In a manual system,

this includes many external files, slips of paper, notes, memoranda, and lists required in the control of ordering, receiving, routing, and cataloging, as well as the more standard circulation files, shelf lists, card catalogs, and routing lists.

Patron information includes all qualifying information relating to patrons and potential patrons. It includes names, social security numbers, addresses, profiles of interest, and security data.

1. Bibliographic Data

The kinds of information required in the operation of an information center, in light of the capabilities of electronic computers, suggested the following general arrangements for maintaining bibliographic information on magnetic tape:

1. A bibliographic file[1] consisting of a lengthy record[1] for each cataloged title in the library.

2. An item inventory file consisting of an abbreviated record for each cataloged item (copy) in the library.

3. An in-process file consisting of a record for each item not yet available for use by the patron.

The first of these files would contain all of the lengthy bibliographic information required in the production of printed catalogs, as well as data for the production of inverted descriptor files for automatic retrieval purposes. For each of these records, there would be at least one and usually several corresponding records on the item inventory file.

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1. Unfortunately, the terms "file" and "record" are specialized terms having definite meanings in library science and not completely analogous meanings in data processing. The terms as used here are meant as data processing terms: "Field" is a set of characters (not all necessarily in the same word) treated as a whole. A field is represented as one or more columns on a punched card used to record similar information. A "record" is a collection of fields, with the information on the record relating to one area of activity in a data processing activity. A "file" is a collection of records. The records in a file may or may not be sequenced according to a key contained in each record.

The second file would contain concise data related to each item (such as call number, title, and whereabouts - loaned, bindery, on-hand, etc.) and would be used for accountability functions like circulation control and routing. Normally, these functions do not require all of the lengthy information contained in the bibliographic file.

The third file would contain information for accountability purposes on all items not yet available for circulation, such as those ordered or those received but not cataloged. From this file, lists of items on order, financial data, and other specific information about items on order could be derived.

2. Patron Data

The following table illustrates the different patron data required by books, documents, and periodicals. Items with asterisks indicate that multiple copies of the information are required.

Elements of Patron Data	Patron Data Required for		
	Books	Documents	Periodicals
Name	X	X	X
Social Security Number	X	X	X
Address (Building Number)	X	X	X
Telephone Number	X	X	X
Agency	X	X	X
* Interest Profile	X	X	X
* "Need to Know" & Date		X	
Security Level		X	
Authority		X	
* Magazines Routed			X
Branch Chief		X	

Ideally, in a completely automated agency (or in one practicing data banking), the maintenance of patron data is a function of personnel and security requirements. In such an environment, the library would add and maintain only those elements of information, such as interest profile and routing data, peculiar to its own operation. Without such an environment, and for a library serving different administrative agencies, it is impractical to secure accord among the agencies on the maintenance and format of common elements of patron data.

The fundamental difference in origin, content, and maintenance requirements of patron data, contrasted with bibliographic data, dictates that the control and maintenance of patron data be accomplished independently of the control and maintenance of bibliographic data.

Thus, the patron file occupies a unique position in the ALPHA System. It is constructed and maintained independently and is made available, as needed, to each of the ALPHA processing systems (books, documents, and periodicals).

For the first generation of ALPHA, patron data accumulation and maintenance are to be accomplished centrally through the use of the computer. Patron information will originate from the patron card (Figure 2) completed by all new patrons. The information is keypunched, and the patron file is updated accordingly. The patron information is maintained on magnetic tape for each patron until he or she terminates employment. Detailed format of the patron record is shown in Figure 3. Additional interest profile and qualifying data are to be added to the format soon.

3. Major Files

In keeping with the distinction between books, documents, and periodicals, three master bibliographic files are proposed - one for each category. The general informational contents of these files are shown by Figures 4 through 6. These files, together with the patron file (Figure 7), comprise the major files of the ALPHA System.

As depicted on Figure 8, the patron file occupies a center position, since it furnishes information to processing activities involving all the other files, and because, symbolically, the patron is the focal point of the RSIC service-oriented philosophy.

C. INPUT GENERATION

To be consistent with the criterion of the earliest machine readability, input data required in the maintenance of the various master files (consisting of both new information and changes to existing information) will be generated at the earliest moment in the system. For new information, input will be generated at the time of ordering or receipt; for changes to existing information, input generation will coincide with the actual occurrence of the change itself.

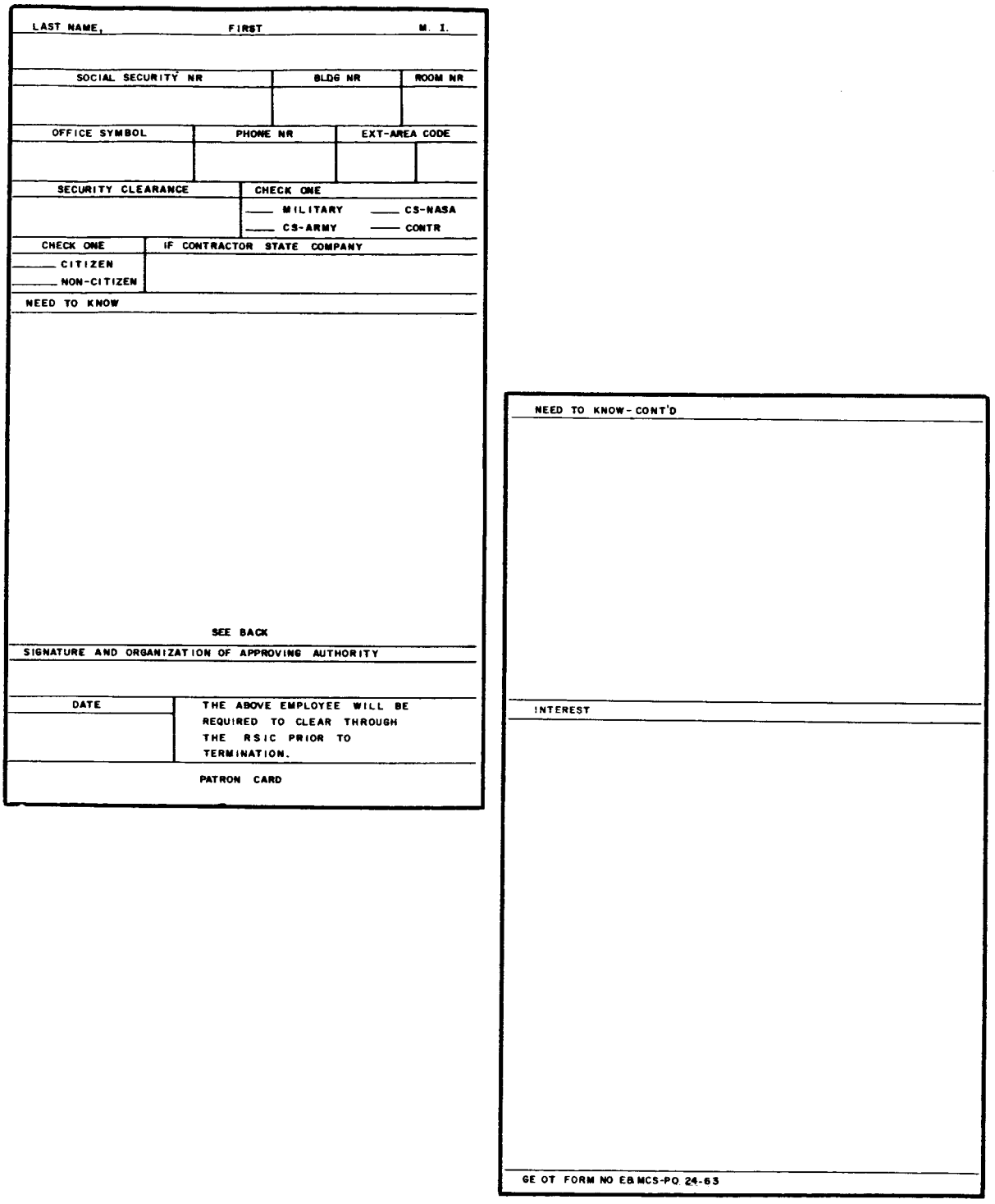


Figure 2. Patron Card Form.

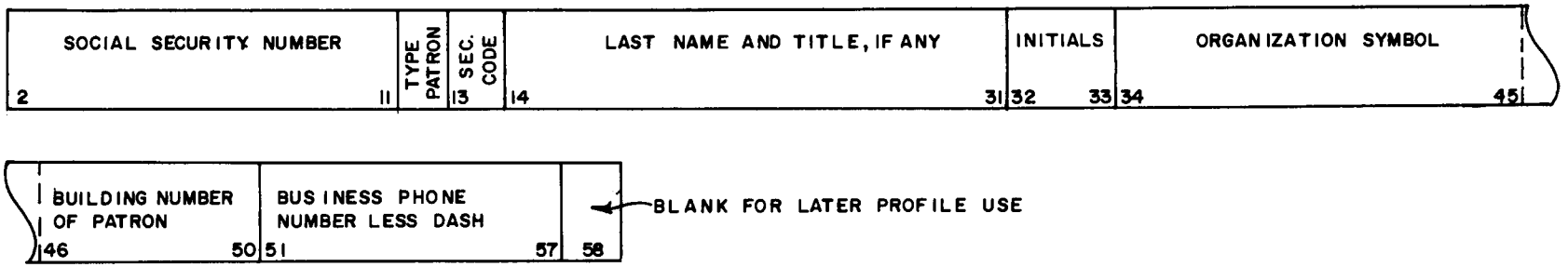
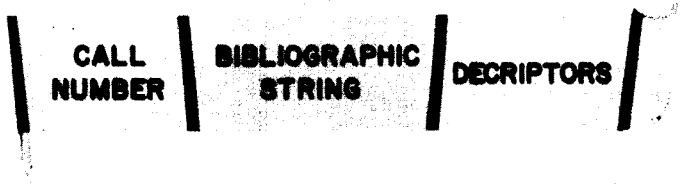


Figure 3. Detailed Format of Record in Patron File.

1. CALL NUMBER
2. AUTHOR (S)
3. TITLE
4. PUBLISHER & PLACE
5. DATE OF PUBLICATION
6. NR. PAGES OR VOLUMES
7. NOTES
8. NUMBER OF COPIES
9. NORMAL SUBJECT TRACINGS
10. DESCRIPTORS



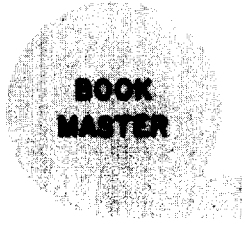


Figure 4. General Informational Contents of Book Master File.

1. DOCUMENT NUMBER (includes date)
2. CORPORATE & PERSONAL AUTHOR (S)
3. TITLE (expandable)
4. ISSUING AGENCY
5. NR PAGES
6. MEDIUM (Microfilm, Roll Film, etc.)
7. ACCESSION NUMBERS
8. CONTRACT NUMBER
9. RESTRICTIONS
10. TOTAL [illegible]OPIES
11. USE [illegible]ENCY
12. DAT[illegible]EIPT
13. DE[illegible]

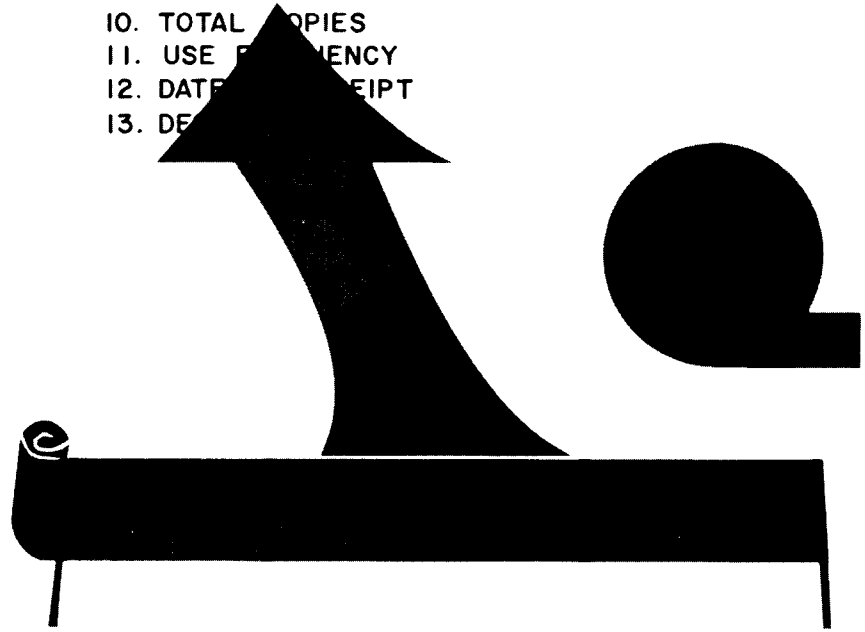


Figure 5. General Informational Contents of Document Master File.

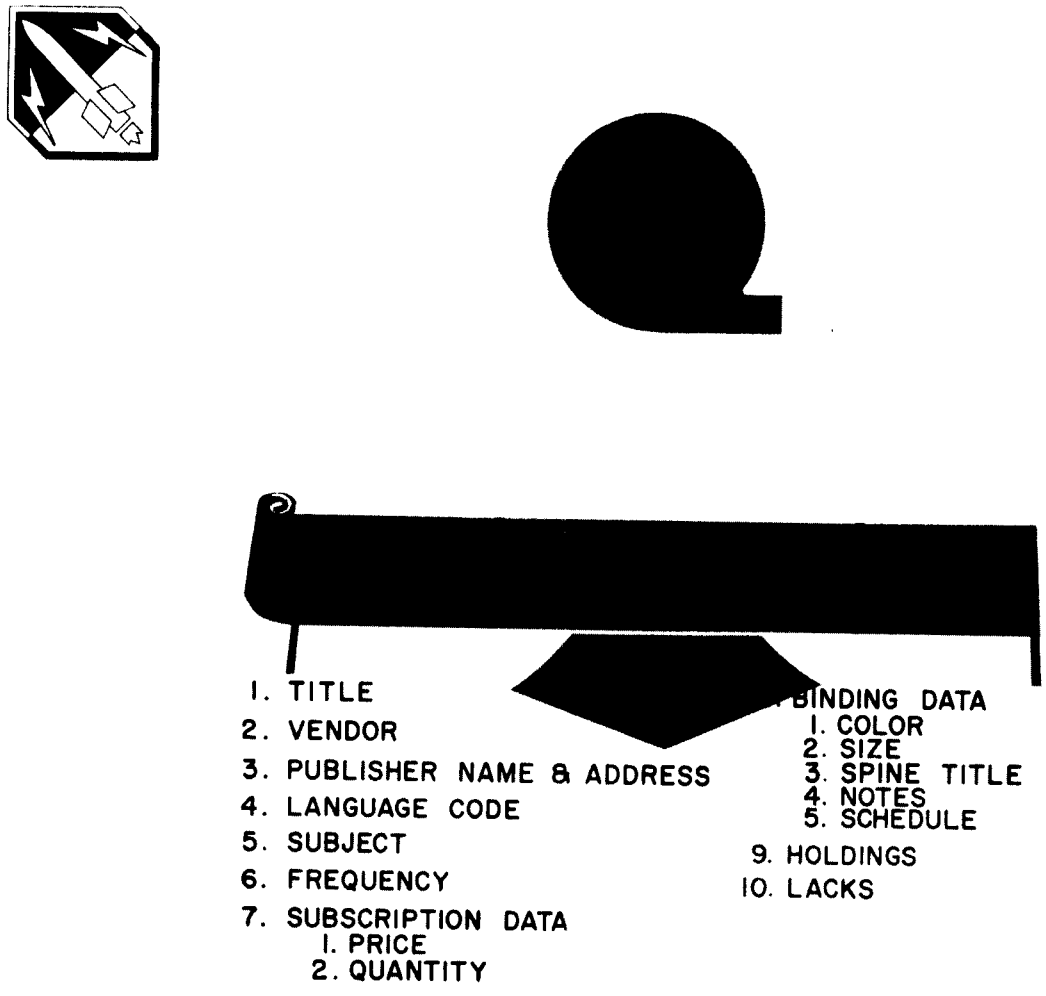


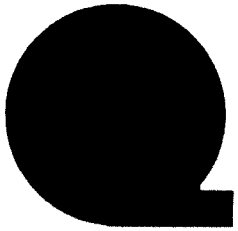
Figure 6. General Informational Contents of Periodical Master File.

1. SOCIAL SECURITY NR.
2. NAME
3. BUILDING NR.
4. OFFICE SYMBOL
5. TELEPHONE NR.
6. PERIODICALS RECEIVED
7. "NEED TO KNOW" CODES
8. FURTHER CHARACTERIZATION
9. INTEREST DESCRIPTORS

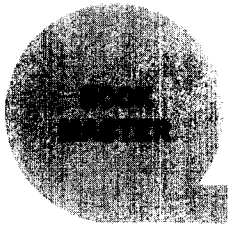
PATRON FILE

INTERESTS SECURITY ADDRESS IDENT

Figure 7. General Informational Contents of Patron Master File.



PATRON



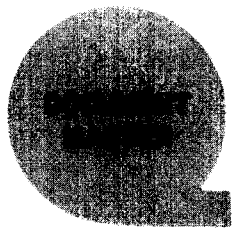


Figure 8. Relationship between Patron and Other Files.

The achievement of earliest machine readability requires special peripheral hardware housed in the library. For ALPHA I, this will include Friden Flexowriters and IBM 632 typing calculators and 026 keypunch devices.

The 632, which utilizes both standard typewriter and ten-key adding machine keyboards, will be used to create card input at the time of ordering. The machine contains sufficient core storage and has enough programmability to permit typing of various required hard-copy order forms while simultaneously producing suitable cards for machine input purposes.

The Flexowriter is suited to the generation of long strings of information, such as machinable abstracts and bibliographies. To attempt this directly through the use of punched cards results in problems of splitting contiguous information among a set of cards each of which must then contain common information identifying the set as well as information specifying the sequential order of the cards. Input originating on punched paper tape will however be automatically converted to cards for input to the central computer. This is done for two reasons: our current machine configuration does not provide for paper tape input and, more importantly, a single input form is achieved for all transactions, which is vital if the "hopper" concept is to be successfully implemented.

An added advantage of both the 632 and the Flexowriter is that they may be used as local output devices, when required, in the generation of special listings and card files.

D. HARDWARE CONSIDERATIONS

Figure 9 illustrates a nearly ideal configuration possible with existing hardware. The configuration is included here to indicate the general goal in the use of conventional types of equipment now available on the market. This generalized configuration was developed as a result of a state-of-the-art survey performed by RSIC and members of the contractor study team.

The hybrid configuration features remote inquiry and transmission via analog means of actual document images. The ability to maintain automatically an actual document store in machine manipulable form is also included.

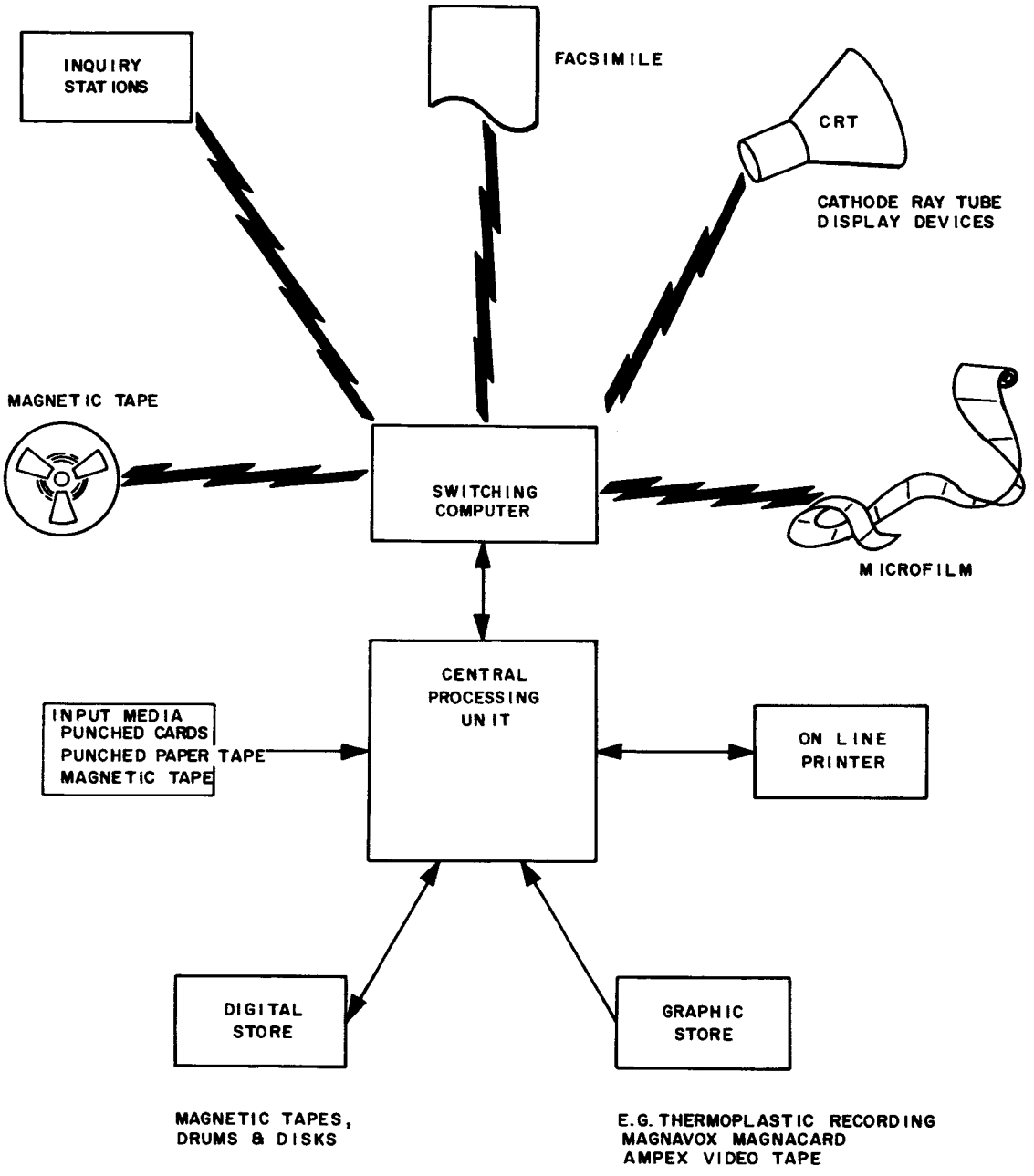


Figure 9. Nearly Ideal Configuration of Existing Hardware.

The central processing unit of the configuration illustrated relies partly on hardware ability rather than software programming to accomplish interrupts, multiprocessing, priority handling, and restoration of interrupted programs. When not servicing remote inquiries, it can be busy performing required serial processing functions of the library or other agencies.

The cost of such a system, solely for information center purposes, is prohibitive at present, except for the largest activities. However, the advent of data banking and shared systems could rapidly make such a system economically feasible.

The USAMICOM Computation Center presently uses an IBM 1410 computer with 14 tape drives, supported for peripheral purposes (card-to-tape, printing, tape-to-punched card) with IBM 1401 computers. Keypunch machines (IBM 026), IBM 632 calculators, and Friden Flexowriters are available for manual data-pickup operations. This configuration is that necessarily postulated for ALPHA I.

IV. OPERATING SYSTEM FOR BOOKS CONTROL

A. GENERAL PROCEDURE

Figure 10 illustrates the general operating procedure for book processing under the ALPHA System. Although the narrative that follows treats only the normal flow of books, exception conditions, such as partial receipt of an order, are covered in detail on the figure.

B. REQUESTS AND RESULTING CIRCULATION ACTIVITY

All requests for books are made to the Library Branch of RSIC on RSA Form 29, shown as Figure 11. These are received by the circulation librarian within the Book Section, and he determines whether the book is a holding and whether a copy is available for circulation to the requestor.

If so, the book is pulled from the shelf, the master circulation card (a punched card) is removed from it, and patron data (patron name, social security number, date, etc.) are added to the loan card. The original form is reproduced, placed with the book, and mailed or given to the requestor; the reproduced copy is dropped in the hopper.

If the book is a holding but a copy is unavailable for circulation, the circulation librarian will refer to the circulation list to see if a copy is overdue or can be recalled. If this results in an available copy, the original request form is filed by author and title in a patron-reserve file.

If the book is not a holding, the circulation librarian refers to the on-order list. If the title is on order and the quantity ordered will be sufficient to cover the additional request, a special transaction card is completed to allocate a copy and to place it on reserve. This reserve-book transaction card is dropped into the hopper. However, if the on-order quantity is insufficient to cover the request, the request is forwarded to the acquisition librarian.

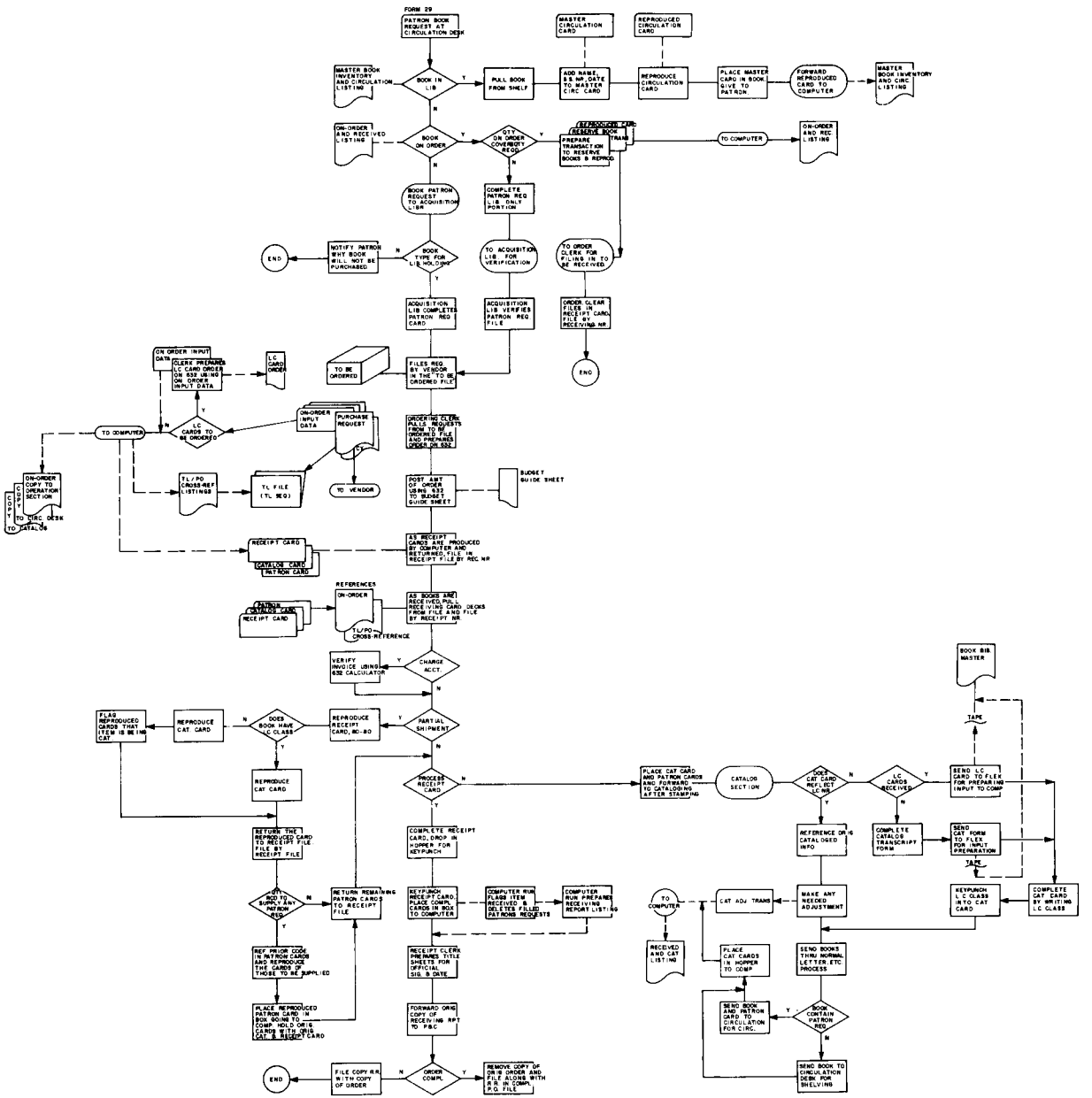


Figure 10. General Operating System for Book Processing.

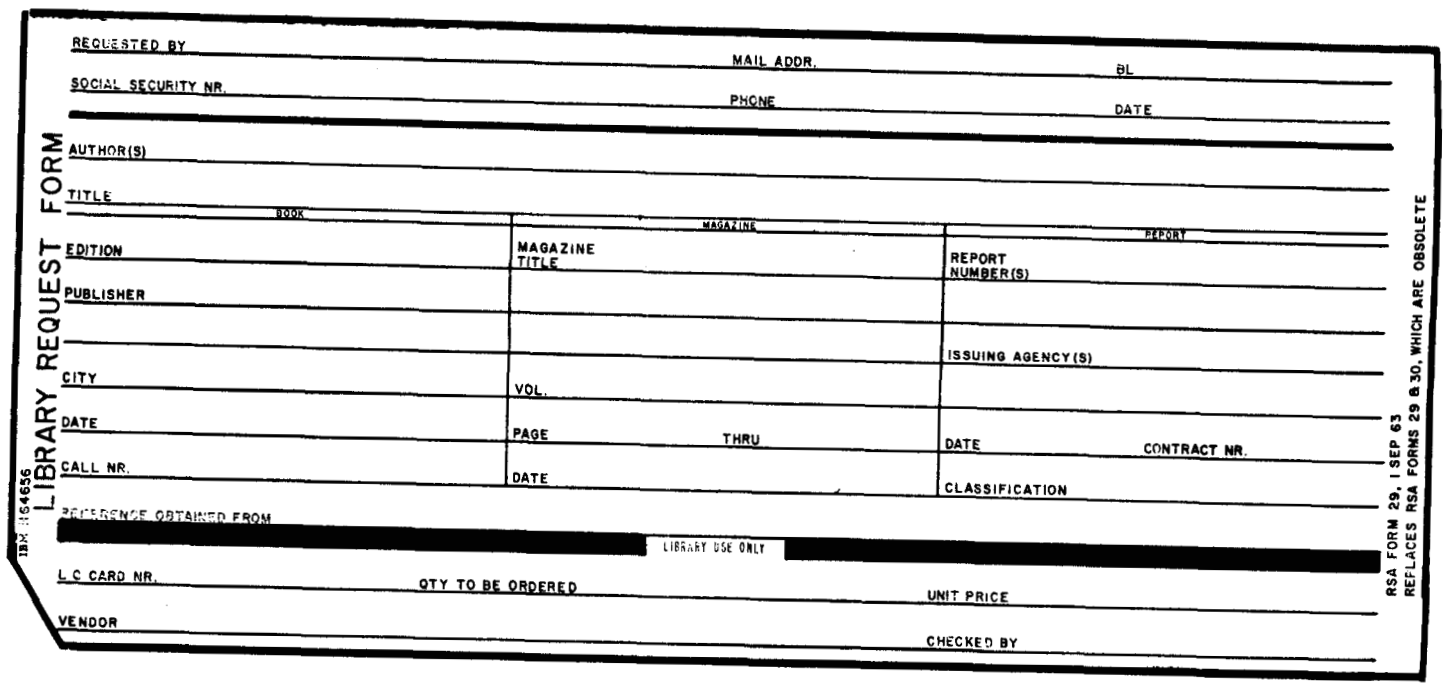


Figure 11. RSA Form 29, Library Request Form.

C. ACQUISITION AND ORDERING

The acquisition librarian screens all requests for books to insure that they are books that should be added to the RSIC collection. If so, he completes the original request form and determines from whom the books will be purchased. Request forms that are completed are separated by vendor.

Every day, the ordering clerk prepares orders for new books. This is done on the IBM 632 typing calculator, at which time punched transaction cards are produced. Hard-copy orders are mailed to the vendor, and the transaction cards are dropped into the hopper.

D. RECEIVING

As new books are received each day, the receiving clerk refers to on-order and cross-reference lists to obtain the receiving card number of the book received. Matching cards are pulled from the receiving card file, completed, and dropped in the hopper. Books with their catalog cards, and with patron request cards, if any, are forwarded to the Catalog Section.

E. CATALOGING

When a book has been received and processed through the Receiving Section, the book together with the catalog card and the patron request card is forwarded to the Cataloging Section for further processing.

Books arriving at the Cataloging Section fall into three categories. One consists of additional copies of titles that have already been cataloged, the second of books cataloged by the Library of Congress but new to RSIC, and the third of books for which complete cataloging must be done.

Because of this, the ALPHA System will permit use of three different levels of cataloger competence and in turn speed up the cataloging process. The first category will require only a catalog trainee or clerk, as only clerical work is needed to finish the cataloging. The second category will require a cataloger with more experience, that is one who is familiar with RSIC's particular application of Library of Congress basic rules of cataloging. The third will require experienced catalogers, as these books often must be carefully perused before proper cataloging.

For processing of the first category through the Catalog Section, the clerk must refer to the machine-produced catalog (in title sequence) to insure that the LC classification on the catalog card is correct. If the classification in the catalog does not agree with the classification appearing on the catalog card, a mistake was made in transcribing the classification at the time of ordering. In this case, the clerk must correct the catalog card in pencil in the space provided on the card for the abbreviated title, copy number, and other information needed for circulating the book.

Transaction sheets will be completed by the trainee or clerk to update the catalog. The books, along with the original catalog card, the patron request card, and the transaction work sheet, are forwarded to a keypunch/Flexowriter operator. The operator reproduces the original card to the LC field and keypunches the correct LC number if an error was made; otherwise, he will keypunch the master circulation cards and place them in the books. If a patron has requested a copy of the book, the operator enters the patron's social security number in the master circulation card, reproduces it, and places the two circulation cards along with the patron card in the book. The patron card will be used to mail the book, once it has been lettered and pocketed.

The books, along with the original catalog card, circulation master cards, and patron cards, are next forwarded for lettering. Once lettered, the books have pockets inserted, the master circulation cards are placed in the pockets, and the books are ready for shelving.

If the book has been requested by a patron (and there are two circulation cards in the book), one of the cards is placed in the hopper to update the circulation master file, and the other is placed in the book. The patron card, containing the patron's address, is taped to an envelope, and the book is placed inside for mailing. The original catalog card goes to the hopper to notify the in-process file that the book has been cataloged.

For processing the second category of books, the LC card set is pulled from the LC card order file. The LC classification is reviewed to insure that the classification is complete enough for RSIC. Any changes to the LC classification are made in pencil on the card. Information to be extracted, such as the LC classification and the number of copies, corporate authors and their address, title and edition, personal authors and their address or credits, publisher and

date, pagination, language and whether it has been translated, and the subject tracings, are underlined. The books, along with the LC card set, are forwarded to the keypunch/Flexowriter operator.

In addition to the operations described in processing the first category of books, a set of cards containing the information underlined, plus the complete LC card, is keypunched. These cards go to the computer and are used to produce a new acquisition list and to update the bibliography file.

The bibliography file in LC classification sequence serves as the present shelf list file. The bibliography file is also sorted by author, title, and subject tracings. Lists prepared by the computer in these sequences are used just as the present card catalog file is being used. The books, along with the master circulation cards, follow the same route as books in the first category for completion of processing.

Upon completion of the cataloging of the third category of books, a card in LC card format is produced by hand. It is forwarded with the books to the keypunch/Flexowriter operator. The operator produces the same cards already described for the other book categories.

While the bibliography file is being built and checked for accuracy, card sets for the present card catalog are punched and produced on paper tape in the same manner as for the present manual system. The computer cards are produced from the paper tape.

F. SUBJECT RETRIEVAL

The algorithm shown in Figure 12 was originally designed for book processing, but it depicts the general approach that will be used in machine searches of all the bibliographic stores of RSIC.

It is unique in that the query terms, as well as the subject file terms, are inverted. This makes possible the asking of unlimited questions against one major pass of the subject file.

While it is difficult to characterize books by a small set of descriptors, an experiment in retrieval will be attempted using the subject tracings present on LC cards and using the Miller search algorithm. It is anticipated that many heretofore unknown correlations can be established among the terms used for subject tracings.

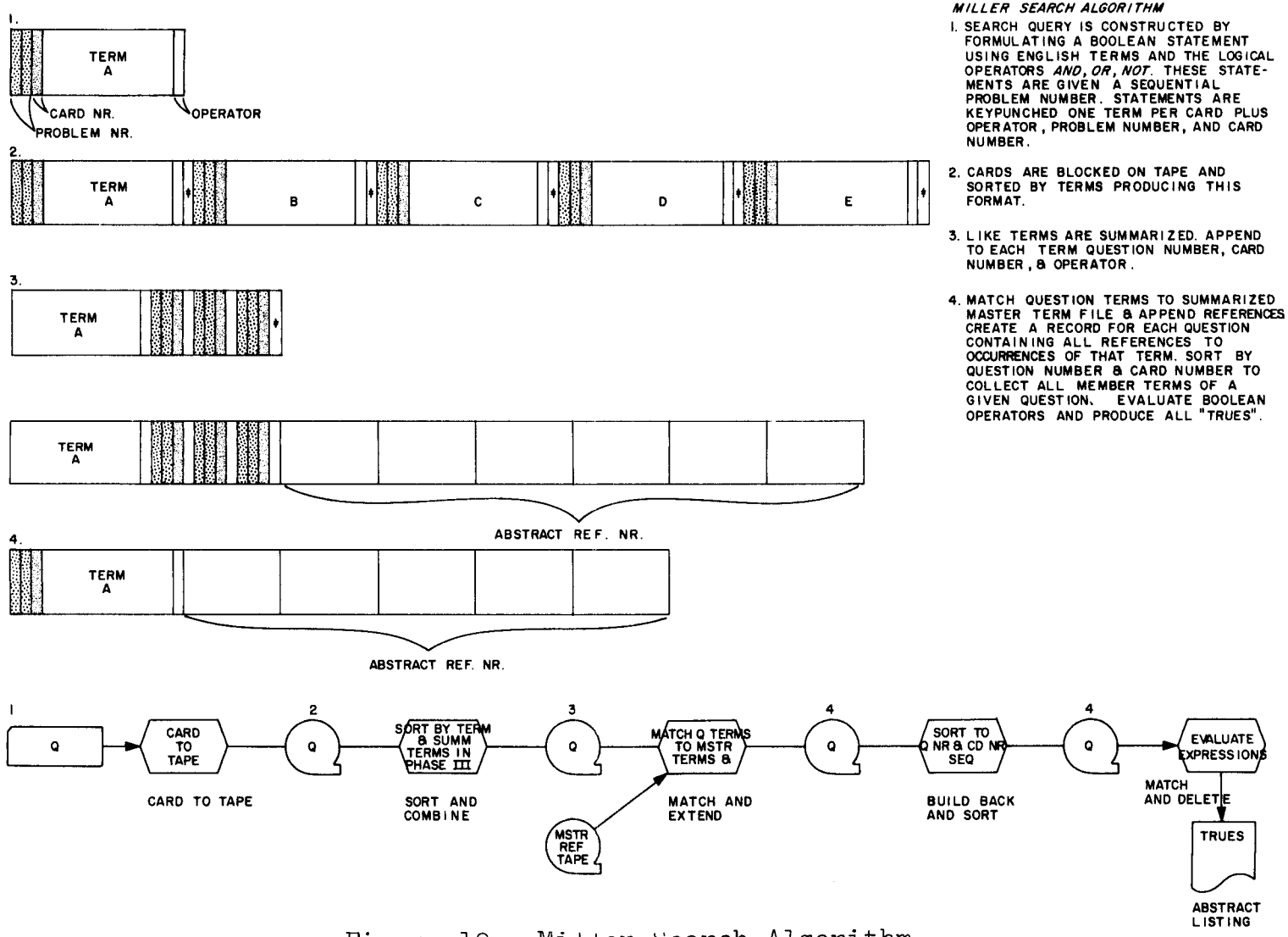


Figure 12. Miller Search Algorithm.

V. OPERATING SYSTEM FOR DOCUMENTS CONTROL

A. FILE ORGANIZATION

As a result of the systems analysis and study, three major and four minor magnetic tape files are recommended for the documents control portion of the ALPHA System.

The major files are:

1. Bibliography file
2. Item Inventory file
3. Patron file

The minor files, all of which are elaborations of bibliography data, are:

1. On-Order file
2. Abstract file
3. History file
4. Descriptor file

All outputs (catalogs, reports, lists, etc.) for the Document Section can be derived from combinations of information from these files. In the following subsections, each file is described, formats are shown and, where output formats are known, examples of outputs are discussed.

1. Bibliography File

The bibliography file is analogous to the card catalog in terms of content. It will contain one record for each title in the collection. Each record will include the elements of information listed below. A 1500-character record from the bibliography file is shown as Figure 13.

1. Security level
2. RSIC call number
3. Corporate author
4. Issuing agency
5. Contract number
6. Title(s) and security classification of title(s)

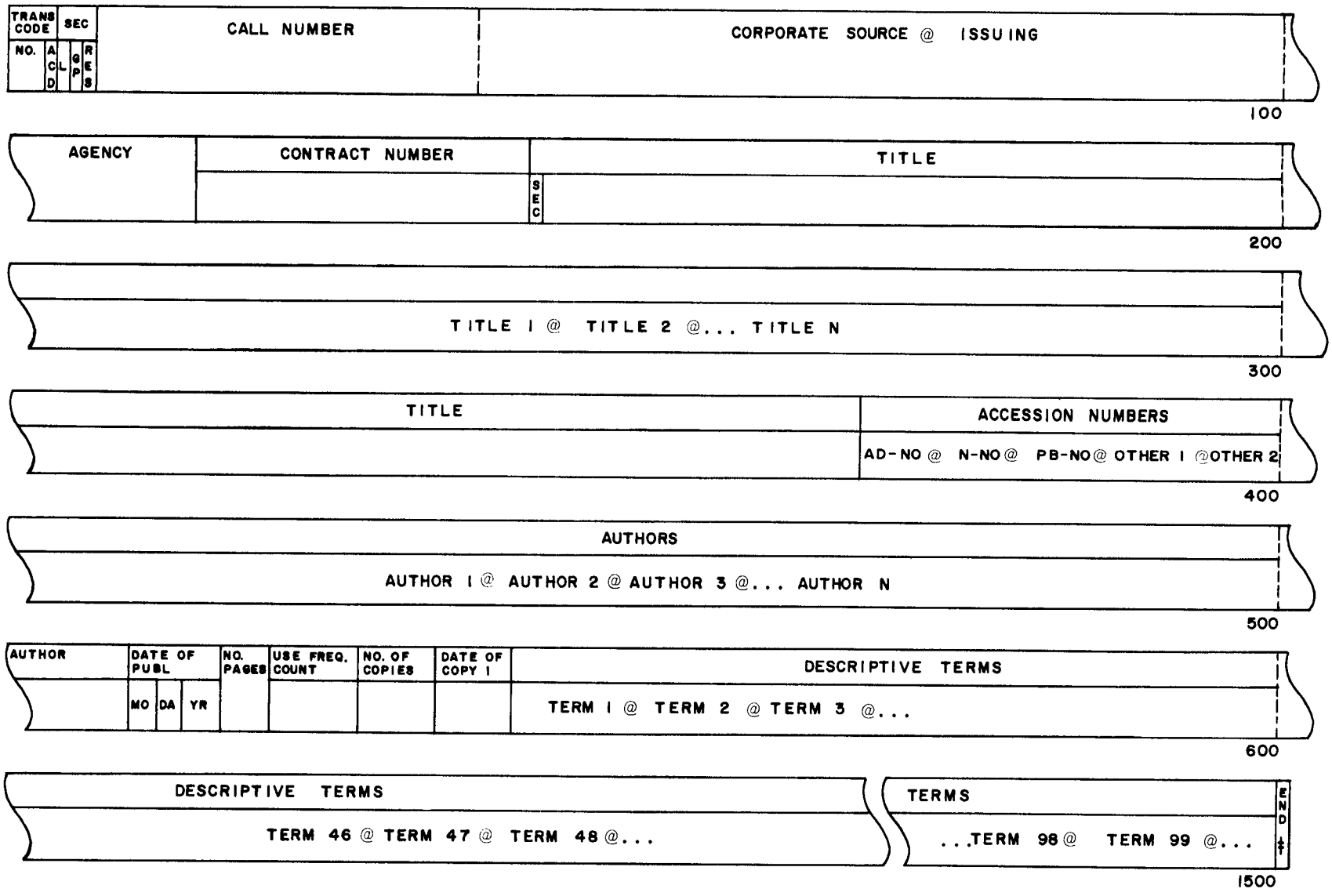


Figure 13. Record Layout from Bibliography File.

7. Acession number(s)
8. Personal author(s)
9. Date of publication
10. Number of pages
11. Use frequency count
12. Total number of copies
13. Date of receipt of first copy
14. Descriptor terms describing the content of the document

The bibliography file can be used in the production of printed catalogs by listing the information in the file in various sequences, such as by:

1. Call number or source (considered the main bibliographic catalog),
2. Personal author(s)
3. Corporate author,
4. Accession number(s),
5. Title,
6. Contract number, or
7. Descriptor (each descriptor of a document acting as a separate subject heading in this case).

Because of the large volume of data involved, it is proposed that all seven catalogs be printed quarterly, with cumulative supplements issued weekly.

Each catalog, except for the descriptor list, will contain the same information - all those items listed above and shown on Figure 13 - but the order will be changed. The descriptor list, because of its volume, will contain only the security levels and call numbers of the documents associated with the descriptors.

Input transactions that update and maintain the bibliographic file originate in punched paper tape created on the Flexowriters by cataloging personnel.

Because the initial conversion of all bibliographic data on 3-x5-inch catalog cards to magnetic tape recorder will require considerable time, both files will be manually maintained until there is sufficient information on tape to rely solely on the magnetic tape file. Therefore, in conjunction with each weekly cumulative supplement issued on items in the bibliography file, 3-x5-inch cards will be printed by the computer for each item entered in the file

for the first time, as source cards, title cards, etc., in the present card catalog. This form of output will be terminated when it is believed by RSIC management that the bibliographic file is at least as comprehensive and useful as the present card catalog.

2. Item Inventory File

The item inventory file will contain one record for each item or copy in the collection. The file will reflect the current disposition of every copy of every document held by the Document Section. Typical examples of dispositions might be on the shelf, in the hands of a patron, in reserve (igloo), and at reproduction.

Each record (Figure 14) will contain only the security classification, call number, and abbreviated title of a document. However, it will also yield a historical record of all activity against each copy of that document. This always includes the copy number, date of receipt, and physical form of each copy, and may also include:

1. Date of removal from, or replacement of, the document in normal storage
2. Type of document action (transaction code)
3. Initials of the RSIC authority responsible for the action and/or the initials of the RSIC employee who carried out the action
4. Date of the action
5. Social security number(s) of the patron(s) involved

Because there may be more than one action on one copy of a document, these will be all included as though they are different actions. Since the file will be printed in call-number sequence, all activities against a given document will appear together in the list.

Item inventory file cumulative supplements will be printed daily, while complete revisions of the entire file will be furnished monthly. Once a month, during the printing of the item inventory file, the file will be purged, and all data referring to completed transactions will be transferred to a permanent history file. The only information retained for completed transactions will be that which permanently affects the document, such as its having been given away or destroyed. Even in this case, only the date

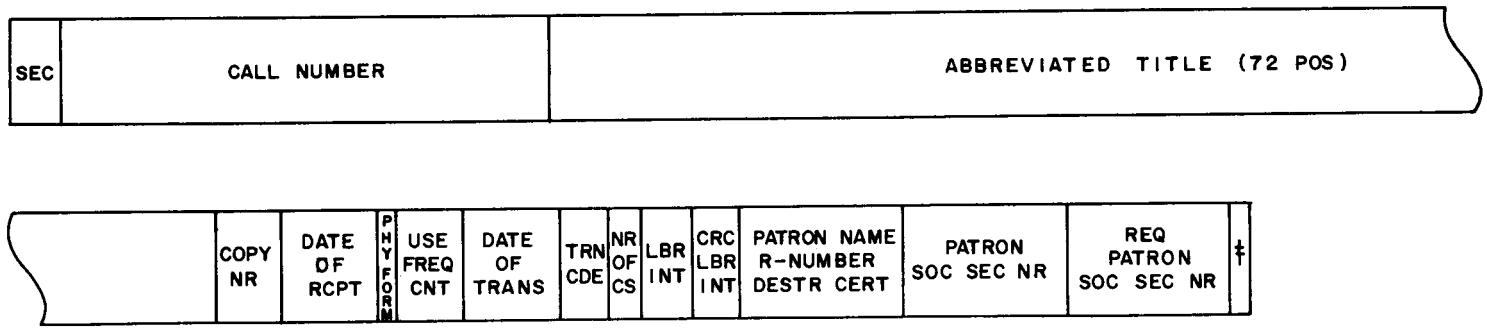


Figure 14. Record Layout from Item Inventory File.

of the action and the type of action will be left in the record. For documents destroyed, the destruction certificate number will also be included if there is one.

3. On-Order File

The on-order file will contain information (Figure 15) about all documents on order.

The ordering typist will use a Flexowriter instead of a typewriter to create orders, and the punched tape output will create the records for the on-order file. On-order information appearing in the DIARY, explained later, will also be derived from this file. In addition, punched library activity cards will be created for filing in an on-order card file at the receiving clerk's desk. These cards will be thrown into the hopper when the documents are received, thus deleting records from the on-order file and transferring them to the item inventory file.

4. Abstract File

The abstract file (Figure 16) will be used as an adjunct to the bibliographic file. Whereas the bibliographic file will contain all bibliographic information about each item, including descriptors, the abstract file will contain only call number and abstracts. The abstract file will be used to produce automated bibliographies upon requests by patrons.

5. History File

The history file will contain data on completed transactions and will eventually store work analyses (Figure 17). It will be updated monthly from information taken from the item inventory file.

Maintenance of the history file will enable RSIC personnel to trace the use history, i.e., audit trail, security check, etc., of any document or patron.

B. DIARY AND RELATED OUTPUTS

Because of the many different types of activities that occur daily in the Document Section, a collective report has been created for use of RSIC personnel. It has been given the name DIARY. As the name suggests, this will be a daily series of reports depicting the transactions that have taken place the day before, as well as the document actions that must take place the day on which the report is issued.

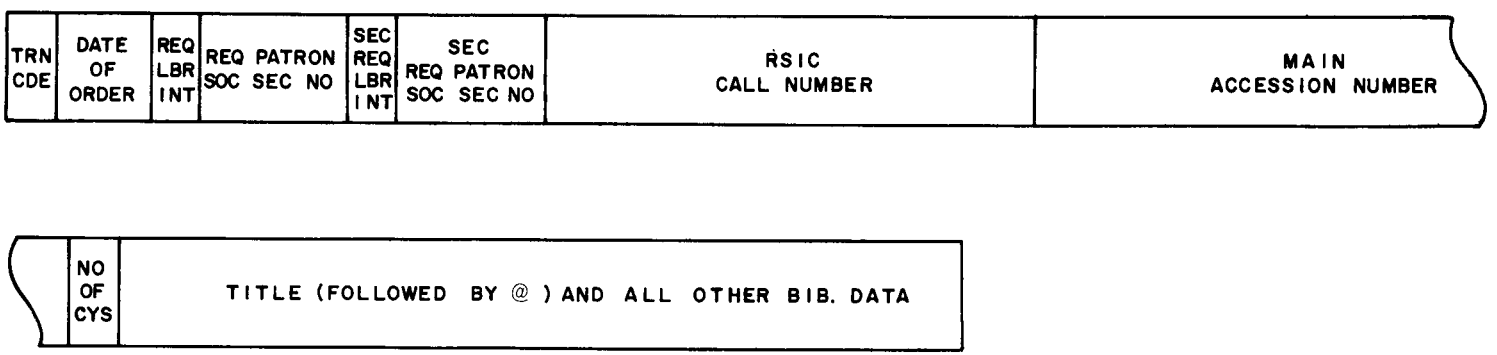


Figure 15. Record Layout from On-Order File.

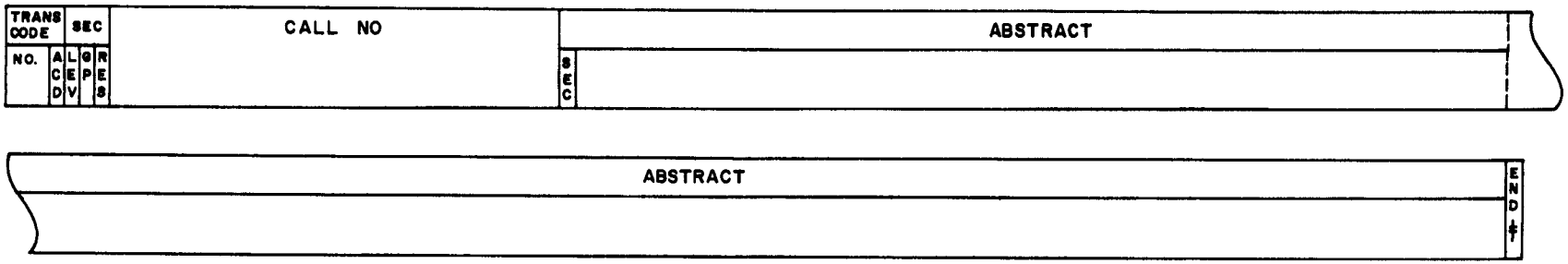


Figure 16. Record Layout from Abstract File.

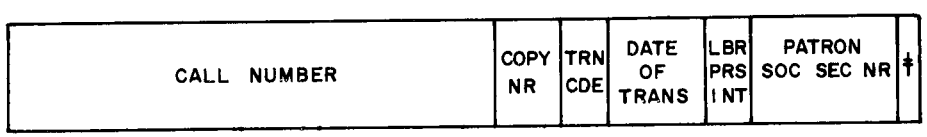


Figure 17. Record Layout from History File.

Information in the DIARY will be constructed from analysis and manipulation of data in the on-order, bibliography, and item inventory files by the computer. A new DIARY will be printed daily.

Appearing on the DIARY will be a production analysis summary (Figure 18). This will consist of the quantitative tabulation of all document actions completed the previous day. It will allow RSIC management to determine the work that must be done to complete in-process document actions and to process remaining documents in a more efficient manner. The daily tabulation will be retained, and a summary report will be printed at the end of each month.

The ability to develop forecasts of important RSIC work trends in all phases of document activity is an important function of the DIARY.

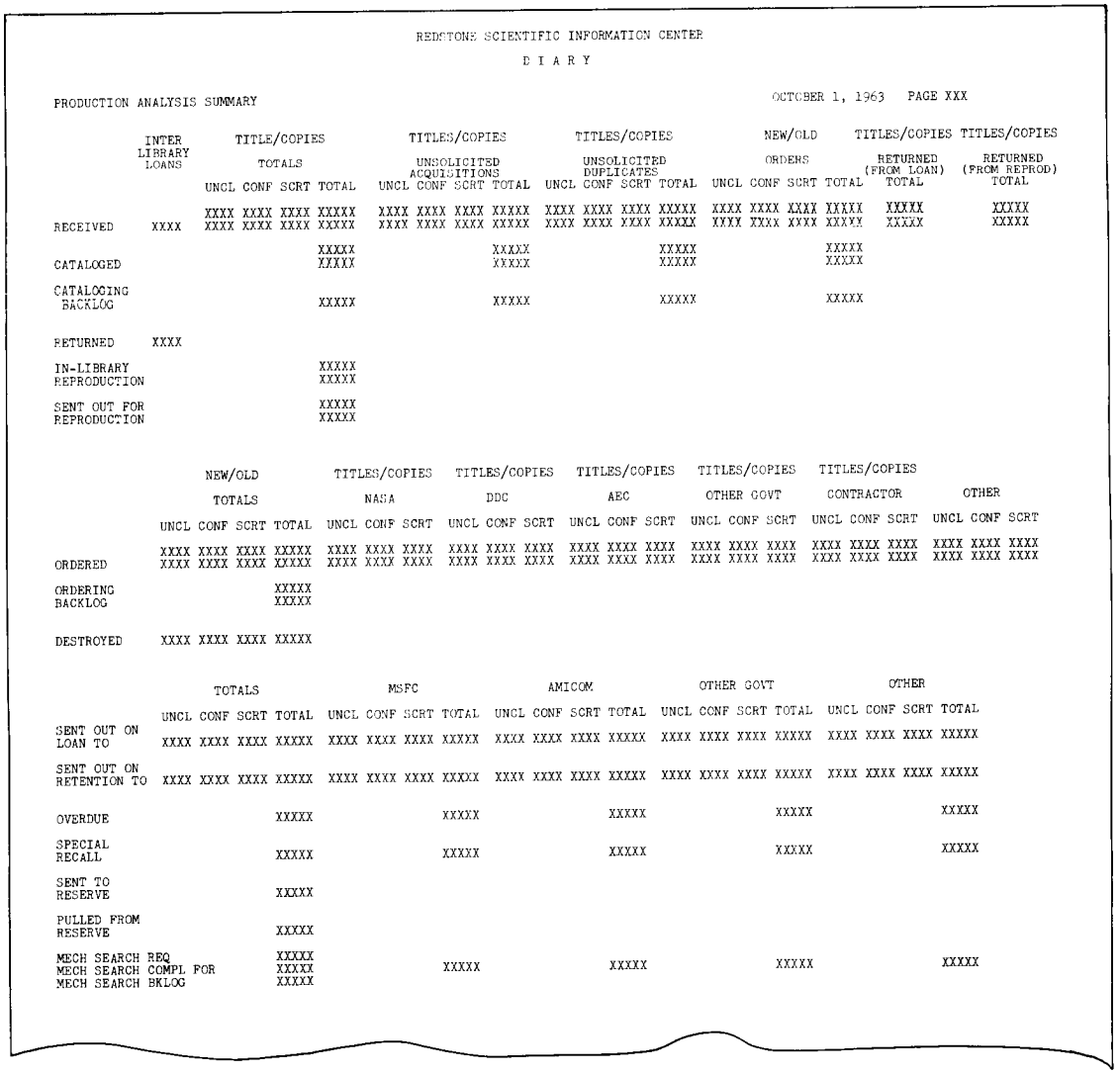
Another part of the DIARY concept will be the weeding worksheet. This will enable the librarians to correlate the updating of manual records with the maintenance of the magnetic tape records.

When documents are retained, destroyed, sent to reserve, sent out on loan, or found to be duplicates, the computer will update the item inventory file accordingly; however, during the transition period between the manual and completely automated systems, both the manual and automated files must be updated and with the least possible effort.

Weekly weeding worksheet summaries will list documents that should be checked either to be destroyed, sent to reserve, or pulled for insertions, reclassification, or errata. In creating these summaries, the computer will take two factors into account: dates of publication and the "use frequency count". The use frequency count is incremented every time patron-document action takes place against a document. In this way, the relative value of the document in the active collection can be determined.

Other reports included in the DIARY will consist of the following:

1. Document Received (Figure 19). A list of all incoming title accumulated daily until the end of the week. This will later be combined with corresponding files



REDSTONE SCIENTIFIC INFORMATION CENTER

D I A R Y

PRODUCTION ANALYSIS SUMMARY — OCTOBER 1, 1963 PAGE XXX

	INTER LIBRARY LOANS	TITLE/COPIES TOTALS				TITLES/COPIES UNSOLICITED ACQUISITIONS				TITLES/COPIES UNSOLICITED DUPLICATES				NEW/OLD ORDERS				TITLES/COPIES RETURNED (FROM LOAN)	TITLES/COPIES RETURNED (FROM REPROD)
		UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL	TOTAL	TOTAL
RECEIVED	XXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXXX	XXXXX
		XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXXX	XXXXX
CATALOGED					XXXXX				XXXXX				XXXXX				XXXXX		
					XXXXX				XXXXX				XXXXX				XXXXX		
CATALOGING BACKLOG					XXXXX				XXXXX				XXXXX				XXXXX		
RETURNED	XXXX																		
IN-LIBRARY REPRODUCTION					XXXXX														
					XXXXX														
SENT OUT FOR REPRODUCTION					XXXXX														
					XXXXX														

	NEW/OLD TOTALS				TITLES/COPIES NASA			TITLES/COPIES DDC			TITLES/COPIES AEC			TITLES/COPIES OTHER GOVT			TITLES/COPIES CONTRACTOR			TITLES/COPIES OTHER		
	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	UNCL	CONF	SCRT	UNCL	CONF	SCRT	UNCL	CONF	SCRT	UNCL	CONF	SCRT	UNCL	CONF	SCRT
ORDERED	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ORDERING BACKLOG				XXXXX																		
				XXXXX																		
DESTROYED	XXXX	XXXX	XXXX	XXXXX																		

	TOTALS				MSFC				AMICOM				OTHER GOVT				OTHER			
	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL	UNCL	CONF	SCRT	TOTAL
SENT OUT ON LOAN TO	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX
SENT OUT ON RETENTION TO	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX	XXXX	XXXX	XXXX	XXXXX
OVERDUE				XXXXX				XXXXX				XXXXX				XXXXX				XXXXX
SPECIAL RECALL				XXXXX				XXXXX				XXXXX				XXXXX				XXXXX
SENT TO RESERVE				XXXXX																
PULLED FROM RESERVE				XXXXX																
MECH SEARCH REQ				XXXXX																
MECH SEARCH COMPL FOR				XXXXX				XXXXX				XXXXX				XXXXX				XXXXX
MECH SEARCH BKLOG				XXXXX																

Figure 18. Production Analysis Summary Portion of DIARY.

REDSTONE SCIENTIFIC INFORMATION CENTER

D I A R Y

DOCUMENTS RECEIVED OCTOBER 1, 1963 PAGE XXX

CALL NUMBER	COPY NUMBER	SEC CLASS	DATE SENT/RECEIVED	REQ LIBR INITIALS	REQ PATRON SOC SEC NR	NUMBER OF COPIES	CURRENT PATRON NAME	CURRENT PATRON SOC SEC NR
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXX	X	XX/XX/XX					

Figure 19. Documents Received Report in DIARY.

from books and periodicals to form a composite book-document-periodical accession list for RSIC patrons use.

2. Overdue and Special Recall Report (Figure 20). A list of all documents presently out on loan in excess of the regulation load period. And, of these, those that have been called in for another patron.

3. Documents in Reproduction (Figure 21). A list of all reports sent to the U. S. Army Field Reproduction Unit.

4. On-Order Report (Figure 22). A list of reports on order.

There will be two other outputs. Delay notices will be printed for sending to patrons whenever the fulfillment of a request is delayed because of reproduction, ordering or reordering, etc. Overdue notices will be printed to be sent to patrons every two weeks following the date on which loaned documents are to be returned.

The DIARY, together with the item inventory list and its supplements, supplies RSIC with all information necessary to locate any copy of a document that is an RSIC holding.

C. INPUT GENERATION

1. Library Activity Entered via Cards

Basic control and file maintenance of the documents control portion of the ALPHA System will be accomplished primarily through use of library activity cards. These cards are specially designed with a generalized format on which can be recorded almost all Document Section activities. Layout of the 80-column card is shown by Figure 23.

The library activity cards will serve both to notify the computer of current activity and to inform the librarian of an expected activity. The former will occur whenever a library activity card is thrown in the hopper; the latter will occur whenever cards are filed in the on-order or on-loan card files.

REDSTONE SCIENTIFIC INFORMATION CENTER

D I A R Y

SPECIAL RECALL & OVERDUE LIST — OCTOBER 1, 1963 PAGE XXX

CALL NUMBER	COPY NUMBER	SEC CLASS	DATE SENT/RECEIVED	REQ LIBR INITIALS	REQ PATRON SOC SEC NR	NUMBER OF COPIES	CURRENT PATRON NAME	CURRENT PATRON SOC SEC NR
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXX	X	XX/XX/XX	(XXX	XXX-XX-XXXX)	XX	XXXXXXXXXX	XXX-XX-XXXX

Figure 20. Overdue and Special Recall Report in DIARY.

REDSTONE SCIENTIFIC INFORMATION CENTER

D I A R Y

DOCUMENTS IN REPRODUCTION

OCTOBER 1, 1963 PAGE XXX

CALL NUMBER	COPY NUMBER	SEC CLASS	DATE SENT/RECEIVED	REQ LIBR INITIALS	REQ PATRON SOC SEC NR	NUMBER OF COPIES	CURRENT PATRON NAME	CURRENT PATRON SOC SEC NR
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXX	X	XX/XX/XX	XXX	XXX-XX-XXXX	XX	ARMY FIELD REPRODUCTION UNIT	

Figure 21. Documents in Reproduction Report in DIARY.

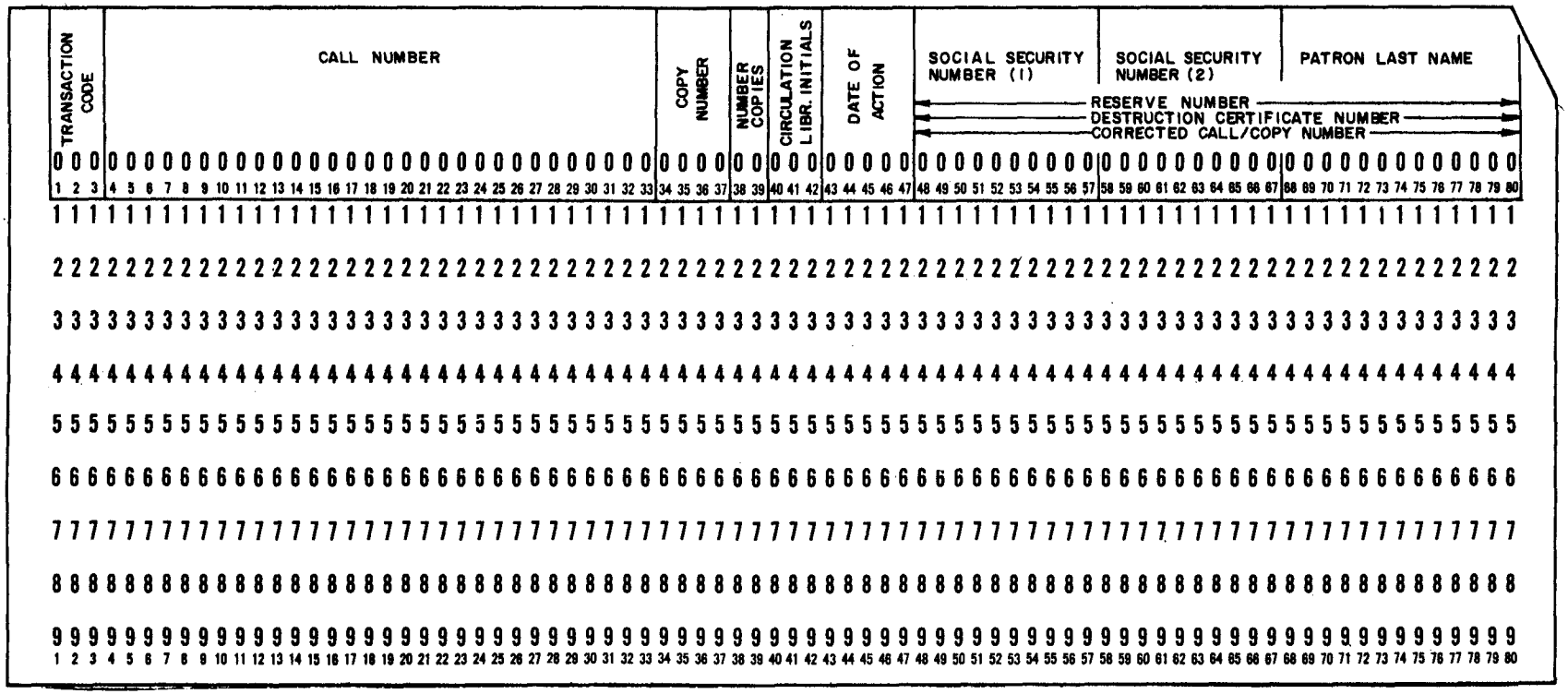


Figure 23. Layout of 80-Column Library Activity Card.

REDSTONE SCIENTIFIC INFORMATION CENTER

D I A R Y

ON ORDER OCTOBER 1, 1963 PAGE XXX

CITATION	REQUESTED FROM	NR OF COPIES	DATE ORDERED	REQ LIBR INITIALS/ REQ PATRON SOC SEC NR	PRIMARY DOCUMENT NUMBER/ (RSIC) CALL NUMBER
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXX, XXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX(ETC)	XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXX	XXX	XX/XX/XX	XXX,XXX XXX-XX-XXXX,XXX-XX-XXXX	XXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXX

Figure 22. On-Order Report in DIARY.

ELEMENTS REQUIRED												
TRANSACTION CODE	CALL NO.	COPY NO.	NO. OF COPIES	LIBRARIANS INITIALS	DATE DUE	DATE OF ACTIVITY	CORRECTED CALL/CY NO.	RESERVE NO.	SOCIAL SECURITY NO.	SOCIAL SECURITY NO.	TRANSACTION REFLECTED	ACCOMPLISHMENT OF CARD
010	X	X	Z			Y					Acquisition	Enters acquisition in item inventory. Lists it in item inventory cumulative supplement. Lists it on acquisitions list (DIARY).
015	X	X	Z			Y					Acquisition of duplicate	Updates item inventory. Lists it on weeding worksheet. Updates item inventory cumulative supplement.
020	X	X	Z	X		Y			X	W	Ordered document came to RSIC for retention	Deletes it from on-order file and list (DIARY). See Acquisition.
025	X	W	Z	X	X	X			X	W	Ordered document came to RSIC on interlibrary loan	Deletes it from on-order file and list (DIARY). Enters it in item inventory with special flag.
029	Y					X	X				Correction of call number on library activity card in on-order card file	Adds it to received-ordered document transaction record.
030	X	X	Z	X		X			X	W	Reordered document came to RSIC for retention	Deletes it from on-order file and list (DIARY). See Acquisition of duplicate.
040	X	X	Z	X		X			X	W	Reproduced document (original and copies)	Deletes it from reproduction list (DIARY). See acquisition of duplicate.
050	X	X	Z			X			X		Returned loan to be returned to circulation for shelving	Updates item inventory file and cumulative supplement.
060	X	X	Z	X		X			X	X	Returned loan on special recall list in DIARY	Updates item inventory file and cumulative supplement. Deletes it from special recall list (DIARY).
160	X		Y	R		X	X		X		Mechanized bibliography request for citation	Creates work file for bibliographic run after editing in daily file maintenance.
170	X		Y	R		X	X		X		Mechanized bibliography request for citation and descriptors	Same as above.
180	X		Y	R		X	X		X		Mechanized bibliography request for citation, descriptors, and abstract	Same as above.
210	X	X	Z	C		X					In-library reproduction	Updates item inventory file and list. One card must be submitted for each copy reproduced.
220	X	X	Z	C		X			X	W	Sent to Army reproduction unit	Updates item inventory file and reproduction list (DIARY).
230	X	X		C	X	X			X	X	Special recall from patron	Updates item inventory file and special recall list (DIARY).
240	X	X		C		X		X			Recall from igloo	Updates item inventory file. Card must be submitted with removed-from-igloo card.
250	X	X		C		X		X			Removed from igloo	Same as above.
260	X	X		C		X		X			Sent to igloo	Updates item inventory file and cumulative supplement.
270	X	X		C		X		X			Returned to igloo	Same as above.
280	X		X	C		X			X	W	Reorder request from on-order list	Updates on-order file and list (DIARY).
290	X		X	C		X			X	W	Reorder request from bibliographic list	Same as above.
500-599	X	X	Z		X	X			X		Releasing a document on loan	Updates item inventory file and cumulative supplement.
600-699	X	X	Z			X			X		Releasing a document for retention	Same as above.

C - Circulation librarian
R - Reference librarian
W - Use only if required
X - Prepare one card for each title, and complete for each card prepared
Y - Complete only one card per title
Z - If more than one copy is requested, complete one card per title
500 - Transaction codes detailed in text
600 - Transaction codes detailed in text

Figure 24. Transaction Codes, Requirements, Functions, etc., for all Activities Affecting Library Activity Cards.

For example, when a classified document is loaned, a library activity card will be completed, reproduced, and thrown in the hopper. The copy of the card will be signed by the patron and will be held in the on-loan card file until the document is returned, at which time the copy will be given to the patron to serve as his receipt and another copy will be dropped in the hopper to record the transaction.

All major and minor files, except the bibliography and on-order files, will be created and maintained directly by input from the library activity cards. The cards will be created by RSIC personnel on keypunch equipment placed at strategic locations throughout the Document Section.

The library activity card has been designed so that a single generalized format serves the many functions required of the card. In each card there appears a transaction code that identifies and determines the exact function of the card. In this manner, only the minimum requisite information must be punched for any transaction.

Transaction codes that have been established are as follows:

5-- Loan
6-- Retention

-1- On-post, Army
-2- On-post, NASA
-3- On-post, contractor
-4- On-post, other
-5- Unused code
-6- Off-post, Army
-7- Off-post, NASA
-8- Off-post, contractor
-9- Off-post, other

--1 Unclassified
--2 Confidential
--3 Confidential, military only
--4 Secret
--5 Secret, military only
--6 Top secret
--7 Proprietary

Figure 24 provides detailed information on both the keypunching of the library activity cards and the functioning

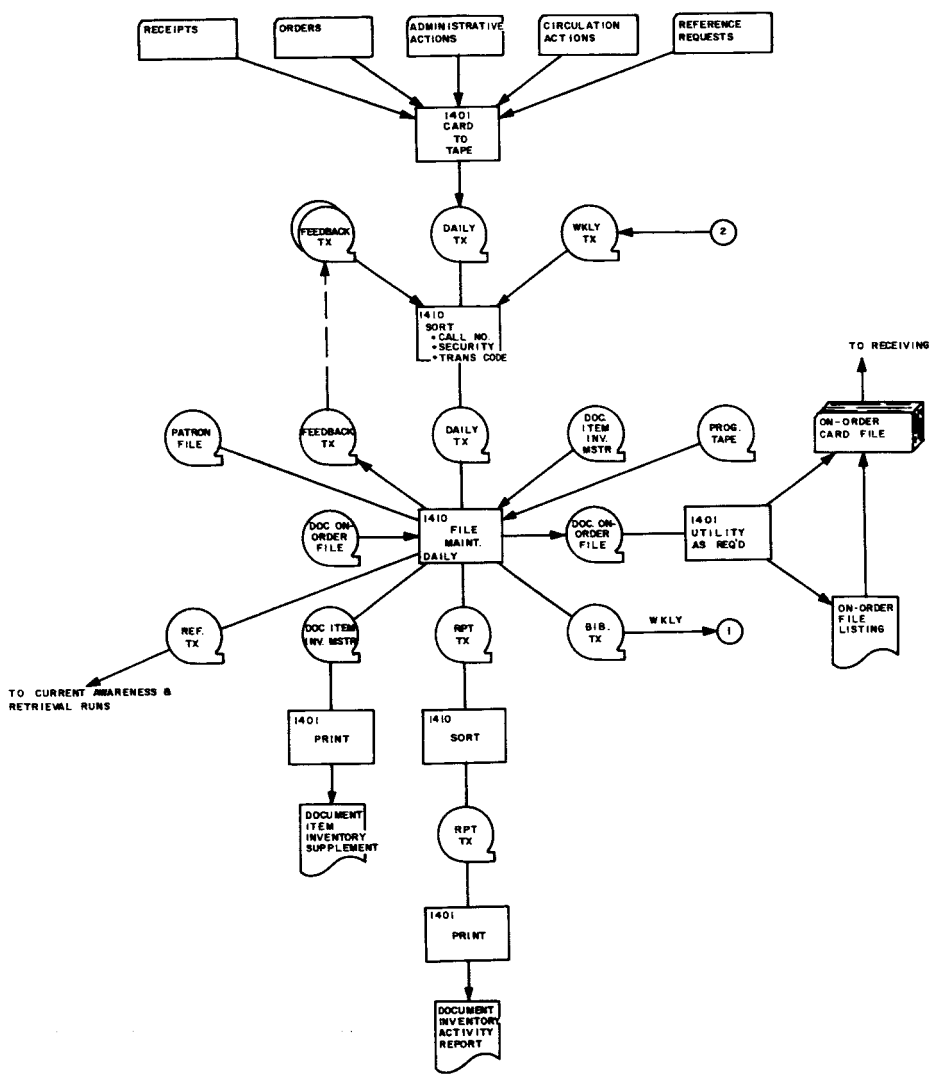


Figure 25. Flow Chart of Daily Automated Document System.

of each type of activity in the maintenance of the automated system. The detail is provided here for reference by RSIC personnel in communicating correctly with the computer. It is also provided for use in programming the process and edit input transactions in the sorts and the daily file maintenance computer run that updates the item inventory file and creates the DIARY. Figures 25 and 26 show the flow charts for daily and weekly file maintenance and processing for the automated system applicable to documents.

2. Ordering and Cataloging Activity Entered via Punched Paper Tape

Punched paper tape input to the computer is similar in basic function to library activity card input. Personnel involved with ordering and cataloging use paper tape to create and maintain their respective files, and at the end of each day, the paper tape is converted along with the library activity cards.

Transaction codes to be used by ordering personnel are shown below.

310	Order, NASA
315	Order, DDC
320	Order, AEC
325	Order, other
340	Reorder, from master file, NASA
345	Reorder, from master file, DDC
350	Reorder, from master file, AEC
355	Reorder, from master file, other
370	Reorder, from on-order, NASA
375	Reorder, from on-order, DDC
380	Reorder, from on-order, AEC
385	Reorder, from on-order, other
399	Correction

The codes will be typed so that they can be recorded right after the document control number on the paper tape but so that they will not be typed on the order form itself. Corrections are made by following the document control number with Code 399 and then retyping the order.

In keeping with the general guide of earliest machinability, cataloging activity input is prepared at the same time as the catalog worksheet is prepared. While the information is typed

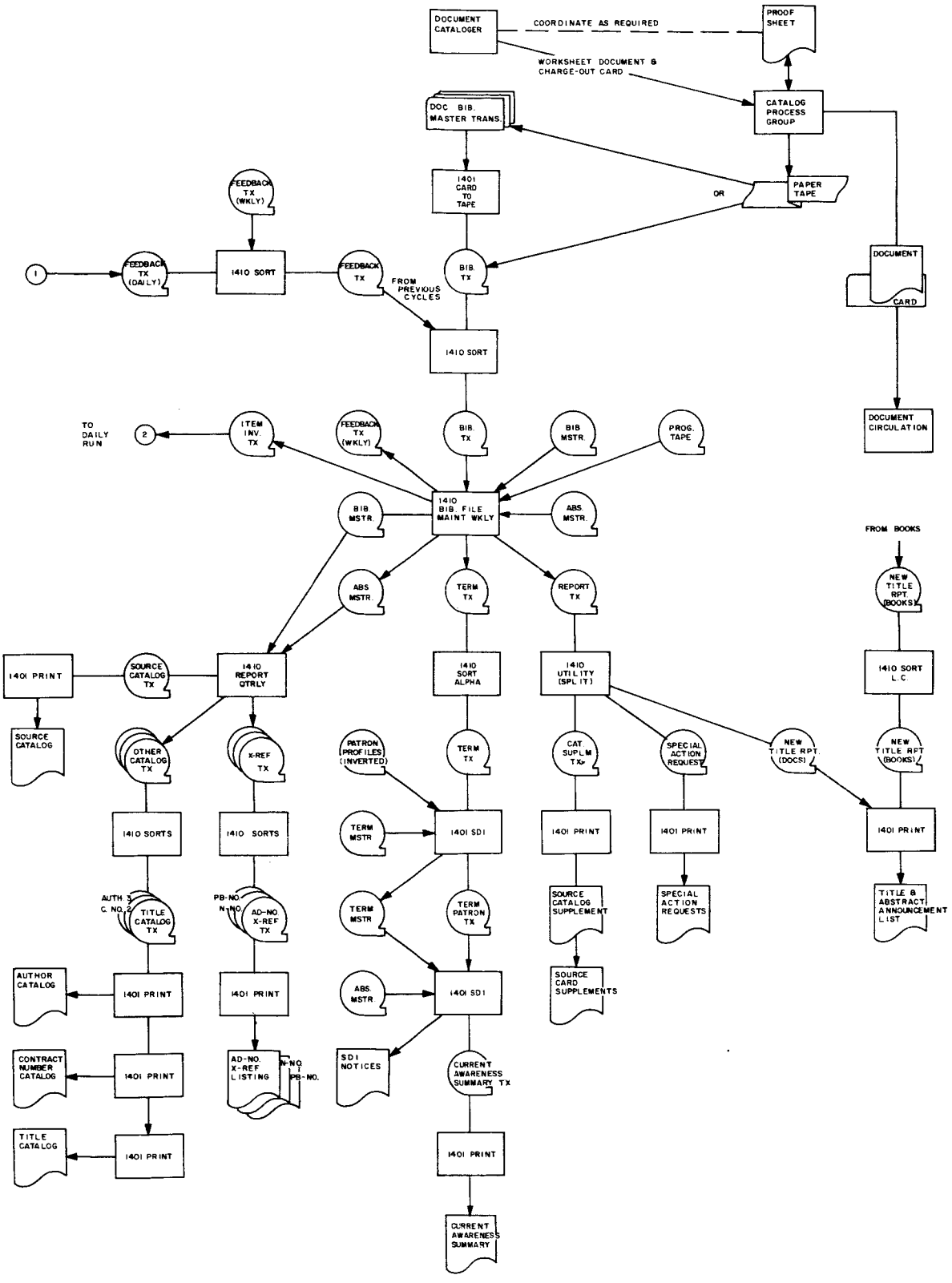


Figure 26. Flow Chart of Weekly Automated Document System.

in relatively free form on the worksheet (Figure 27), a punched paper tape is simultaneously produced. The tape contains both the information and a line count of the information. The tape is used to create three items: a punched card for each line of information used to maintain the document bibliography and item inventory files, a proof sheet used primarily for corrections, and a title and abstract announcement list for subsequent reproduction. If required, the tape can be retained for automatic reproduction of any number of catalog cards. This procedure eliminates time-consuming reproduction, currently used for preparation of RSIC catalog cards.

The catalog worksheet contains instructions along the left margin for the ordering of fields and subfields. The form imposes no complicated set of rules for any information transcribed onto the form itself. Figures 28 through 30 illustrate catalog information as it appears on the worksheet, punched paper tape, and finally the keypunched card.

Record marks (≠) appearing on the cards are produced by the carriage return character in the punched paper tape. These allow defined tape records to be created directly from the cards. Function codes (case, carriage return, etc.), used to control Flexowriter output, are punched into the card so that lower case may be indicated by overprinting or may be printed when printing devices with lower cases become available.

D. OPERATING SYSTEM

1. General Activities

From an analysis of the over-all flow chart of RSIC activities, the functional activities of the Document Section can be broadly characterized as:

1. Acquisition (ordering and receiving)
2. Cataloging
3. Circulation
4. Reference

Figure 31 is a generalization of the activity of RSIC as viewed from the flow of document data through an automated system.

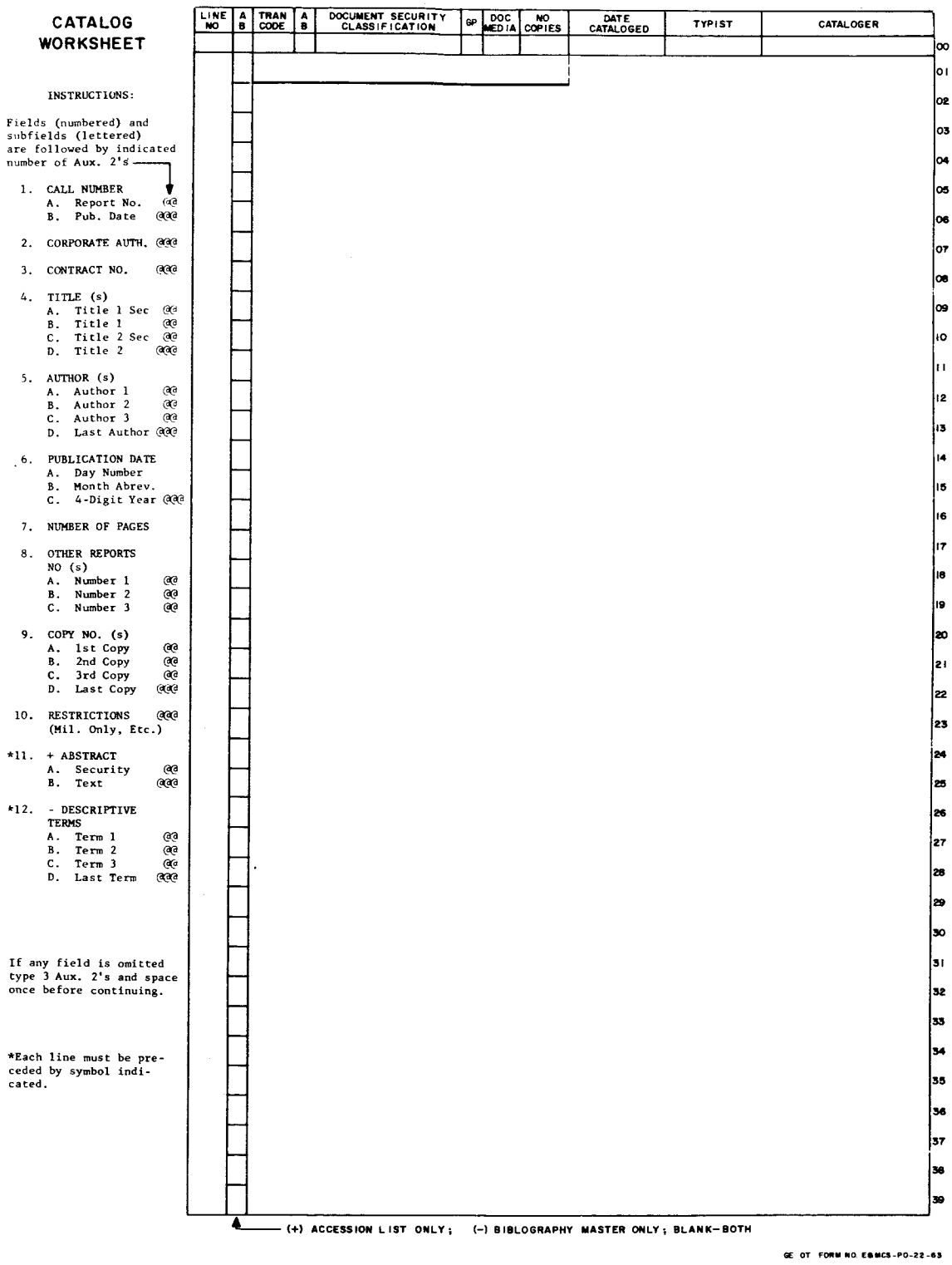


Figure 27. Catalog Worksheet.

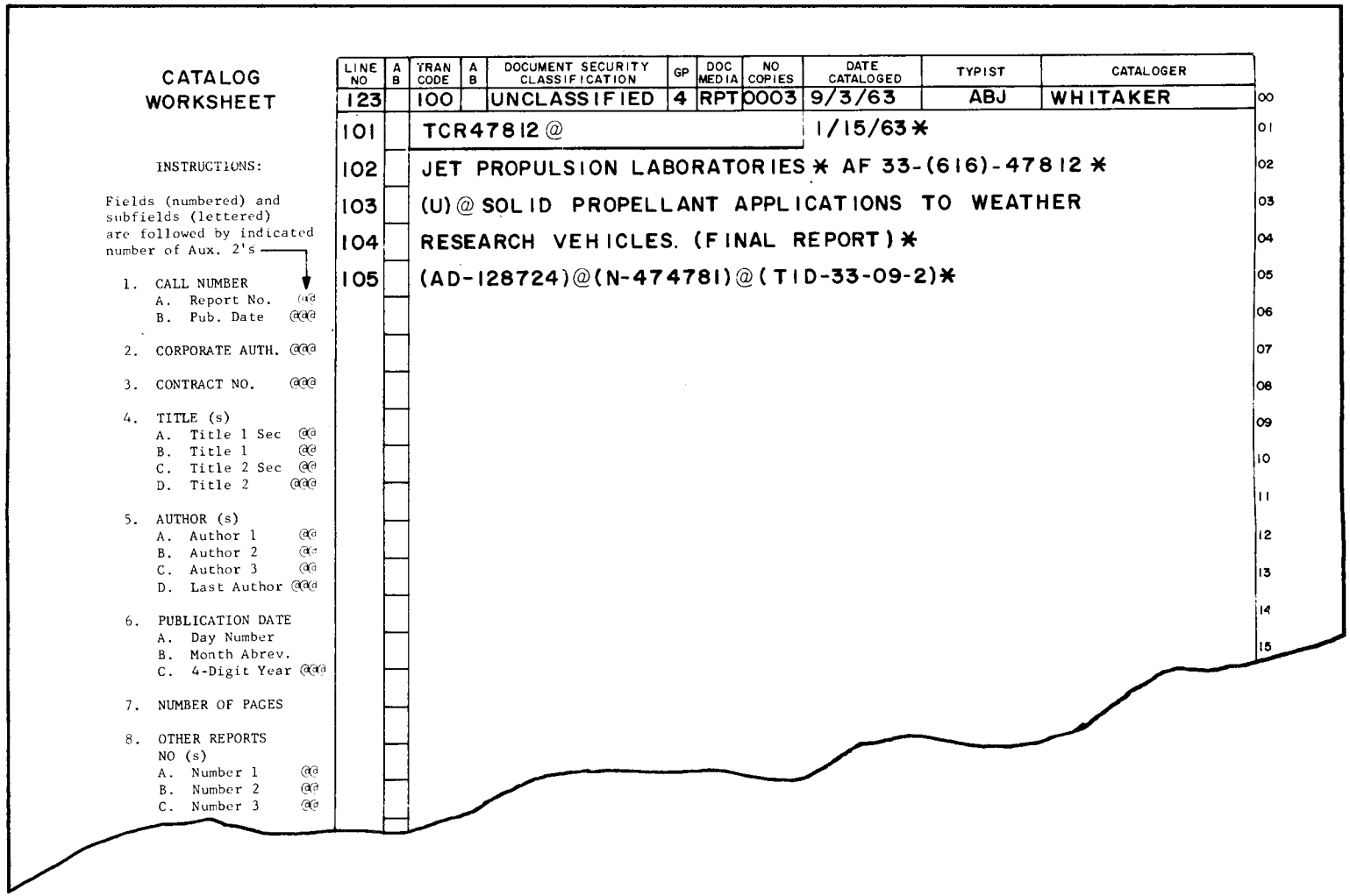


Figure 28. Catalog Worksheet, Showing Sample Entry.

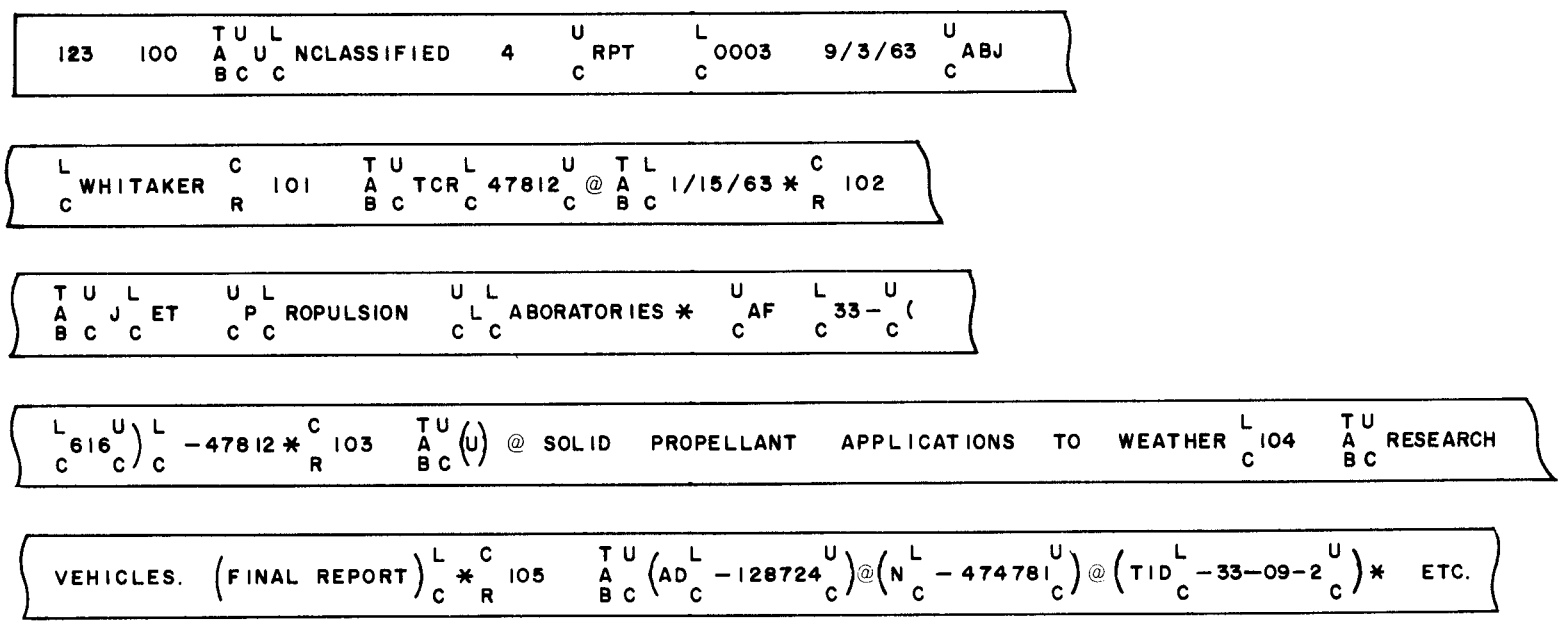


Figure 29. Resulting Punched Paper Tape.

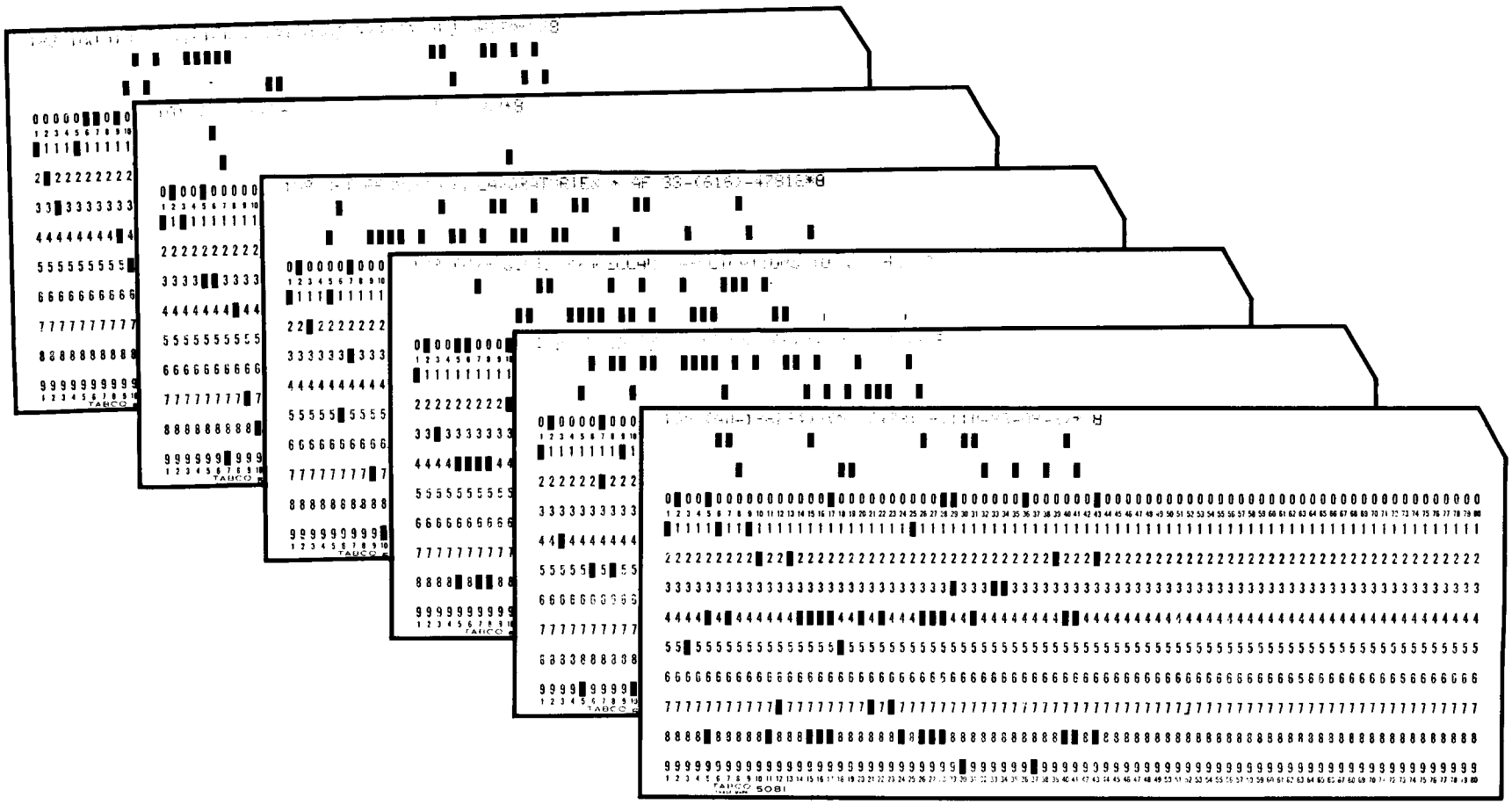


Figure 30. Resulting Keypunched Cards.

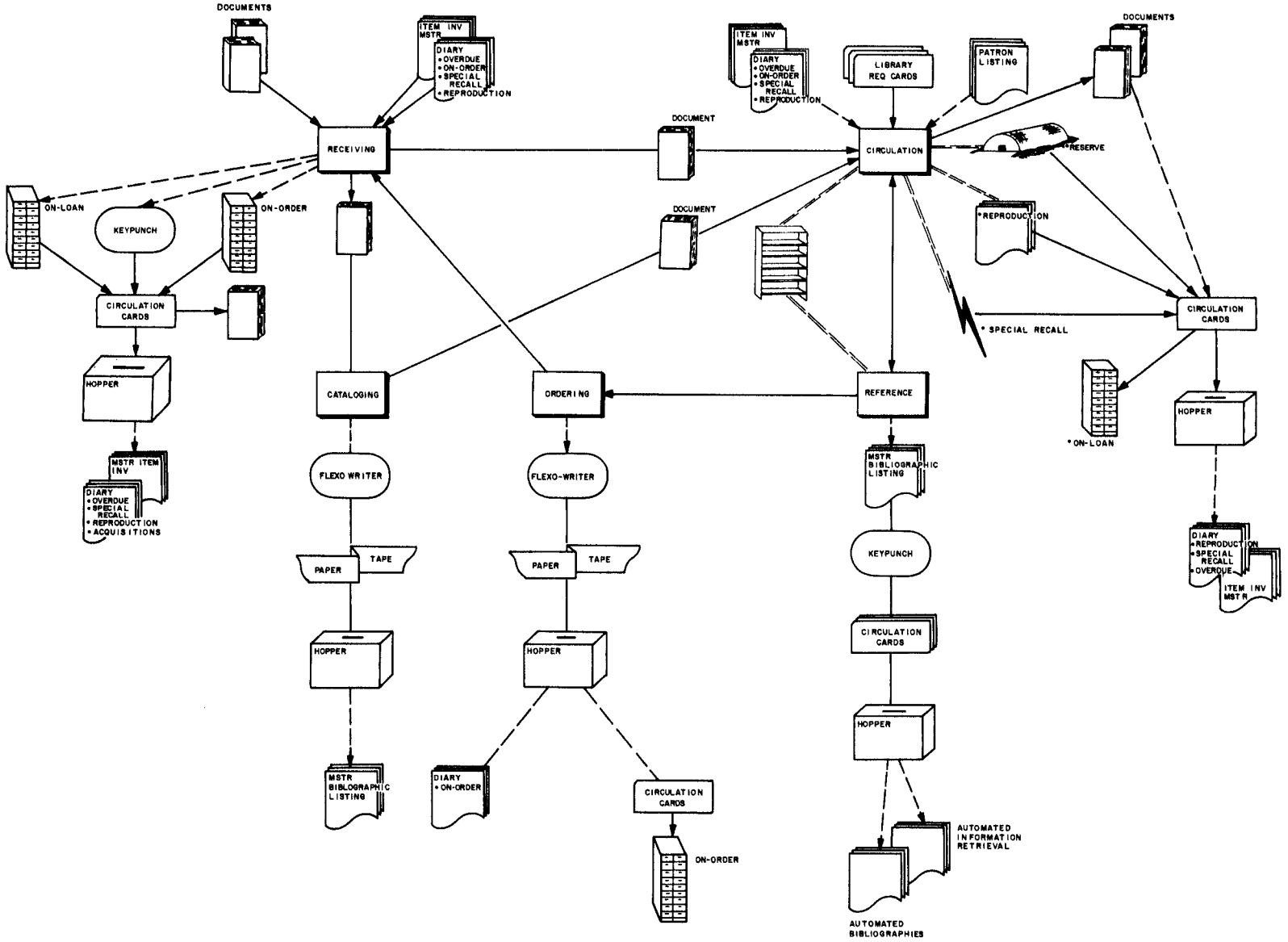


Figure 31. Flow of RSIC Document Data through an Automated System.

2. Documents Entering or Leaving RSIC

As depicted in Figure 31, all documents entering RSIC will be channeled through the receiving area, and all documents leaving RSIC will be channeled through the circulation area.

If documents received are new titles that were not ordered, two library activity cards are keypunched for each copy received, one going into the hopper and the other in the document. If the document was ordered, the library activity card is pulled from the on-order card file and used to make the other two cards.

From the receiving area, the document goes to the cataloging area, where all bibliographic and other identifying information (including abstracts or descriptors) are typed out on a Flexowriter. The document is then routed to circulation, and the paper tape created by the Flexowriter is used to update the bibliographic and item inventory files.

If the received document is a returned loan, its library activity card is pulled from the on-loan card file and duplicated, one card being thrown into the hopper and the other going with the document to the circulation area. If the document is coming back from reproduction, its library activity cards are punched with information from the reproduction list in the DIARY. Again, one card goes to the hopper and the other accompanies the document to the circulation area if it has been cataloged or to the cataloging area if it has not.

Circulation personnel coordinate all document distribution and storage activities. Documents coming from the receiving area are either shelved or sent to a waiting patron. Requests for documents are filled by retrieving documents from the shelf or by auxiliary methods such as ordering, reordering, special recall, reproduction, and ordering from reserve. The determination of which of these methods to use is enhanced by use of the machine-produced item inventory list and the DIARY. Any auxiliary action that takes place is reflected on the DIARY as a further aid to circulation and in determining the status of incoming documents by the receiving activities.

If requests coming from patrons do not ask for any specific documents, they are sent to the reference area. Reference librarians search through all bibliographic lists and standard references to obtain the call number of documents needed to satisfy the requests and either give them back to circulation personnel to retrieve the documents or punch the call numbers on library activity cards and throw them in the hopper. The latter causes the computer to issue

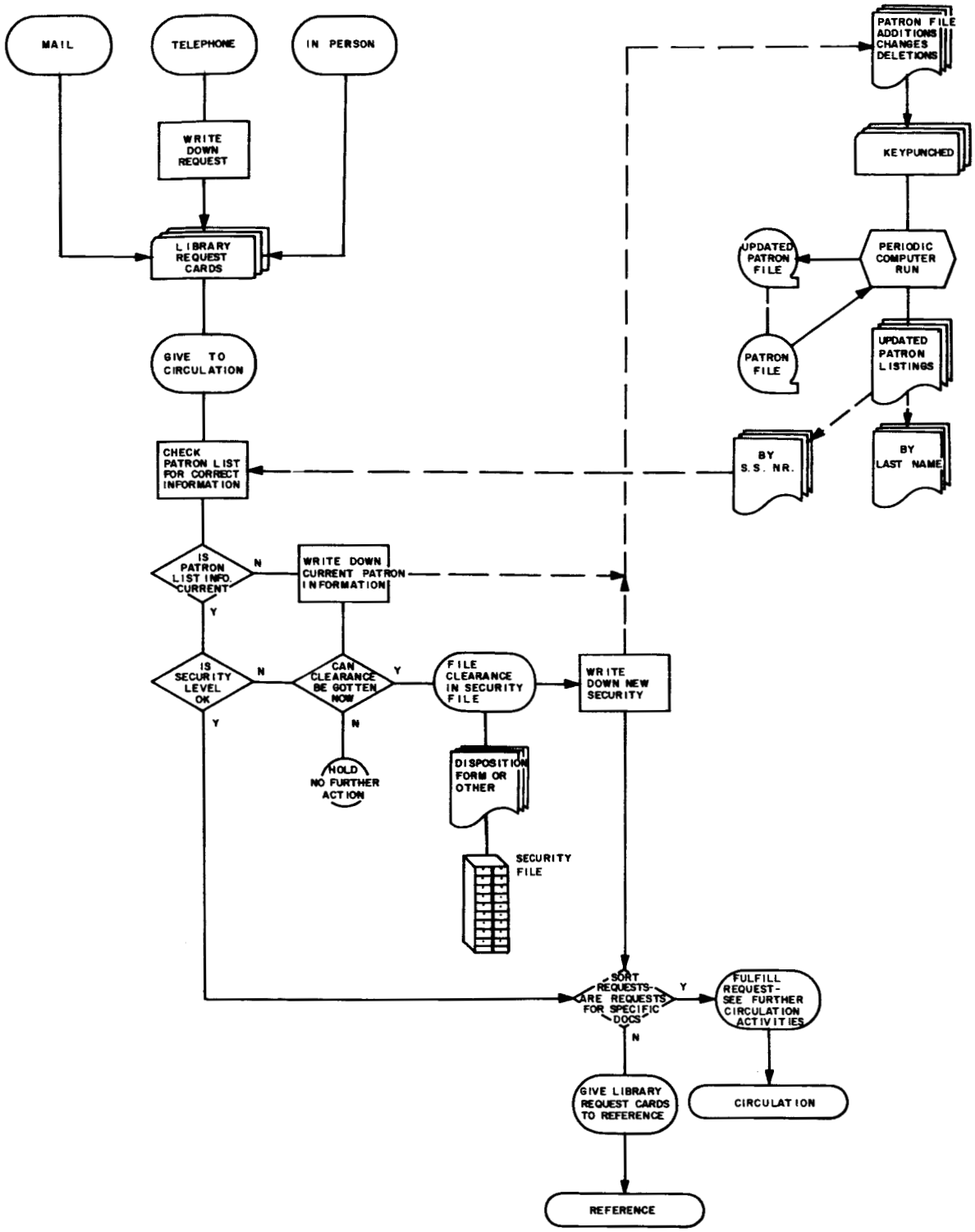


Figure 32. System Chart for Service Requests.

(During the course of the ALPHA Study, the term circulation card as applied to documents was found to be confusing, and it was subsequently changed to library activity card. Rather than re-do already lettered charts, references to circulation cards were left on some charts, and the revised term should be substituted.)

a complete formal bibliography, with or without abstracts, which is then sent to the patron. If a reference librarian feels the patron's request is suitable for an automated information retrieval search, the request is translated into the proper terms and format for the automated IR system, is keypunched, and is thrown in the hopper. Again, a formal bibliography will be produced.

All documents going to a patron are also handled through the circulation area. The library activity card of each document is thrown into the hopper, and if the document is going out on loan, a duplicate is filed in the on-loan file. The mailing address of the patron is determined by consulting the patron list. The cards going into the hopper will generate an updated item inventory supplement with a record of copies sent out.

3. Service Requests

Figure 32 is the system chart for document service requests. As shown on the chart, requests for service arrive either by mail, over telephone, or through personal visit. All patrons utilize the standard library request card (Figure 11) in making requests. This form enables the librarian to sort and process requests on an availability or method of acquisition basis, rather than on a patron basis. In addition, it provides all necessary information about the patron and his request.

If the library request cards arrive by mail, they are forwarded directly to the circulation librarian. If requests come by phone, they are written down on the card. If patrons bring requests in person, they fill out their own cards. All requests cards initially go to circulation personnel.

In the circulation area, the patron list is checked to make certain that all information is correct and current and, if necessary, to insure that patron security classification is at least equivalent to the classification of the requested document. If patron information is absent or incorrect, correct data are entered on the patron card form (Figure 2), which is then used to update the patron file.

Circulation then separates library request cards into requests for specific documents and requests for information or bibliographies. The latter are sent to the reference librarians.

4. Reference

If the reference librarian believes that the request on a library request card is best answered by automated searching techniques, the request is formulated into terms and format acceptable to the computer.

To accomplish this, the thesaurus and word frequency list for synonyms that would aid in extracting documents pertaining to the question are searched. The question, reduced to terms and descriptors, joined together by Boolean operators, are keypunched and processed by the Miller search technique (Figure 12). The computer search will produce a bibliography, which will be sent, together with the library request card, to the patron.

If the reference librarian believes that the request is not suitable for a computer search, bibliographic printouts and standard references will be used in a manual search. Figure 33 lists and briefly described the seven standard RSIC document references that are manually searched.

If the request can be filled by a short set of related facts, the reference librarian writes them on the back of the library request card or on an accompanying slip and sends the card and slip to the patron. If, however, either a bibliography or actual document can be furnished, the call number of each relevant report is written on the back of the card.

If the request is for a bibliography, the library request card is given to an assistant who keypunches one library activity card for each document with the:

1. Call number of the document,
2. Number of copies of the bibliography needed,
3. Social security number of the patron,
4. Date,
5. Reference librarian's initials,
6. Number of the bibliography request, and the
7. Transaction code (Figure 24).

The cards are processed by computer, a full bibliography in proper format is printed, and it is given to the assistant for checking against the call numbers on the request. The bibliography is sent to the patron, using the library request card as the address on the envelope.

1. CHEMICAL PROPULSION MAILING LIST. Chemical Propulsion Information Agency Publication 16, June 1963.

   An official document that establishes the authority and mechanisms for direct exchange of chemical propulsion technical information up to and including Confidential, among Government facilities and contractors listed.

2. DIRECTORY OF MISSILE INDUSTRY REPRESENTATIVES.

   Directory of contractors in the Huntsville, Alabama, area.

3. CONSOLIDATED LISTING OF SECURITY COGNIZANCE ASSIGNMENTS FOR DEPARTMENT OF DEFENSE CONTRACTORS' FACILITIES. DOD Consolidated listing, Security Clearances, 15 March 63.

   Alphabetical list of facilities for which security cognizance has been assigned to an activity of one of the three military departments.

4. GUIDED MISSILE TECHNICAL INFORMATION DISTRIBUTION LIST. DOD Report MML 200/23.

   The Department of Defense sponsors a primary distribution system for the dissemination of technical guided-missile reports. This publication furnishes a list of addresses of government agencies and Department of Defense contractors currently participating in this distribution system.

5. AMERICAN UNIVERSITIES AND COLLEGES. Irwin, Mary, ed., American Council on Education, Washington, D. C., 1960.

   List of accredited institutions by state, their requirements, locations, etc.

6. THOMAS' REGISTER OF AMERICAN MANUFACTURES. Thomas Publishing Co., New York.

   List of American manufacturers published yearly.

7. UNITED STATES GOVERNMENT ORGANIZATION MANUAL. Office of the Federal Register, National Archives and Records, General Services Administration.

   Official organization handbook of the federal government. It contains descriptive sections of the agencies in the legislative, judicial, and executive branches. Supplemental information following these sections includes brief descriptions of quasi-official agencies and selected international organizations, charts of the more complex agencies, and appendixes relating to abolished or transferred agencies, government publications, and certain ancillary material.

Figure 33. RSIC Standard Document References.

If the reference librarian decides to sent the patron those documents believed to be important to him, the library request card (with the call numbers of the documents on the back) will be sent back to the circulation area where they will be handled as a regular request for specific documents.

For each of those documents not listed in the library indexes, however, a new library request card is completed and given to the ordering typist. Documents on the library lists may have to be pulled and examined to make sure they are relevant. If so, the reference librarian also gives those documents to circulation personnel with the original library request card.

Under this procedure, the reference librarian uses only a minimum amount of time in clerical functions, such as pulling and filing, most of which will be accomplished by the circulation staff.

5. Main Circulation

The circulation librarian receives library request cards directly from patrons and via the reference librarian. These may arrive with document call numbers written on the backs and sometimes with accompanying documents pulled by the reference librarian for examination.

Figure 34 is the systems chart of activities within the main circulation area.

For each request, the circulation librarian first checks the item invnetory list and its cumulative supplement to determine if there are enough available copies of the document to fill the request. As this implies, at least one copy of each document in the active collection must always remain reserved on the shelf for in-library use.

When the item inventory list is checked and it is found that there are insufficient available copies for the patron, it must be decided whether to:

1. Reproduce the library copy,
2. Reorder more copies of the document,
3. Recall overdue copies or copies not overdue but that may be recalled, or
4. Recall a document from reserve.

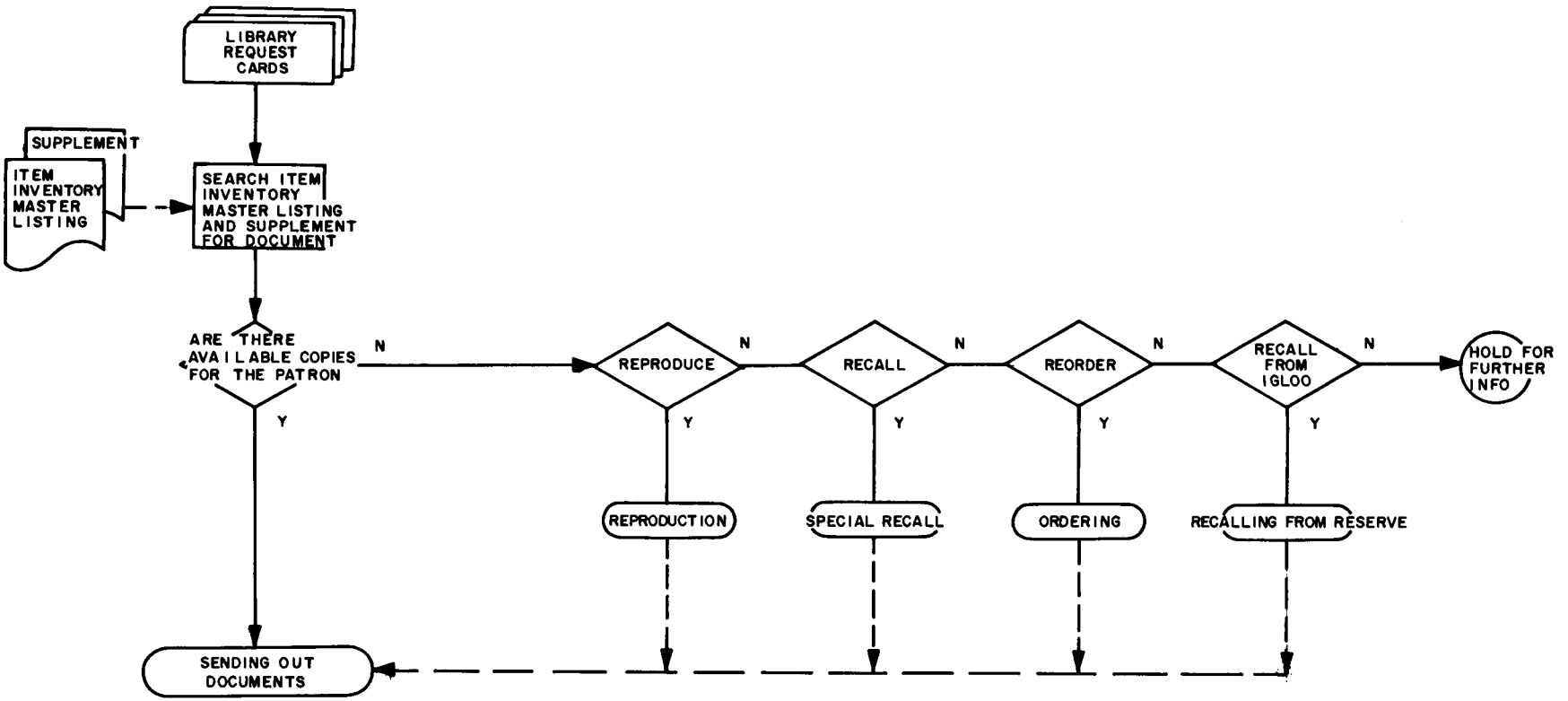


Figure 34. System Chart for Main Circulation.

Although this decision is subjective, the item inventory list will aid. The number of pages of the document, as well as the present location of each copy, yield good clues as to the best method of obtaining copies.

It is believed that an in-library reproduction machine operator would significantly reduce the administrative burden posed by use of other reproduction facilities, and therefore this is recommended as a method of facilitating the reproduction of documents.

6. Sending Out Documents

The system chart that reflects activities concerned with sending out documents is shown on Figure 35.

If copies are available, the document is pulled from the shelf (or reserve, reproduction, etc.), and if classified, it is examined. Patron need-to-know is verified by comparing data on the patron list with the material covered in the document. If his need-to-know is insufficient, he is notified, and all action on the request is suspended (the document put back on the shelf and the library card, or a copy of it, retained in a special suspense file) until further information on the patron is obtained.

If the patron's need-to-know is adequate, or if the document is not classified, the circulation librarian must determine whether to loan the document or give it to the patron. This again is a subjective decision and must be decided by standing policy.

It has been decided as a matter of RSIC policy that a loan should be for a specified period of time. All documents must either be returned within this period, or at the end of the period, the period of time must be renewed. This will not only aid in document control (inclusive of security control), but will provide a more extensive collection of documents on hand to serve patrons. This will also enable document records and files to be minimized and thereby enhance the automation picture.

Once it has been determined whether to loan or give away a document, the library activity card is removed from the document and the following information is keypunched (or checked if it had been keypunched previously):

1. Social security number of patron,
2. Initials of the circulation librarian responsible for issuing the document, and the
3. Transaction code (Figure 24).

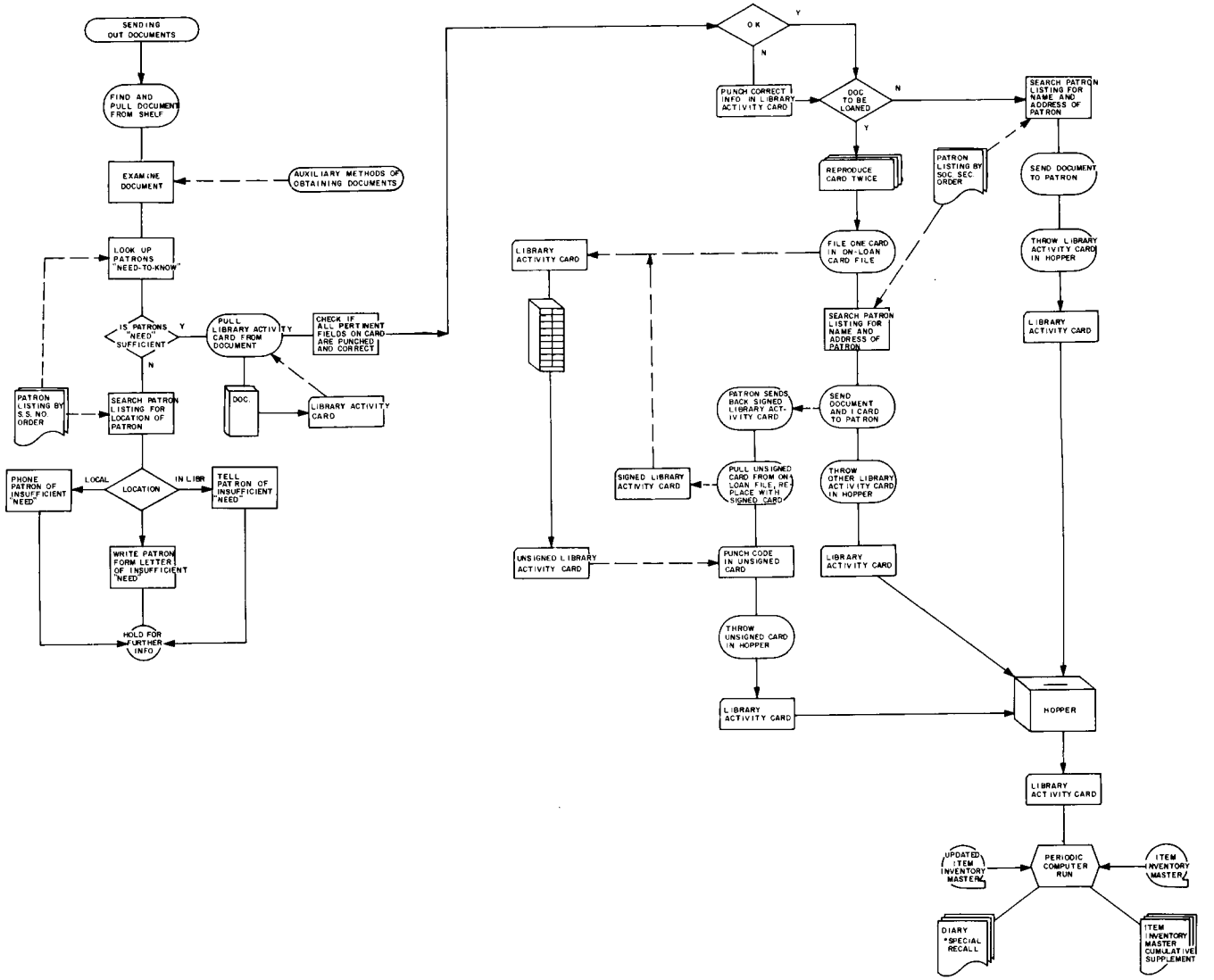


Figure 35. System Chart for Document Releases.

If the document is going out on retention, it is given to a clerk, who attaches a security cover sheet and wraps the document according to security regulations. Wrapping is not necessary if the patron is present, and wrapping and the cover sheet are both unnecessary, of course, if the document is unclassified. The original library request card is attached to the envelope to serve as the mailing address. If the library request card is not available, the clerk refers to the patron list (by social security number) and addresses the document from this. The document is sent out, and the library activity card is thrown into the hopper. The next day, the item inventory file cumulative supplement reflects the new borrower's social security number, the notation "retention", the date the document went out, and the initials of the circulation librarian responsible for issuing the document.

If the document is going out for retention, the library activity card is thrown in the hopper at the time it is given away. This updates the item inventory file only.

At the end of each month, all information on retention items will be transferred to the history file. On the new item inventory printout, the notation "retention" will appear adjacent to the copy number of the retained item.

If the document requested is going out on loan, the library activity card is reproduced twice. The original card is sent to the patron for his signature and return, the first copy is inserted in the on-loan file as a temporary receipt until the signed card is returned, and the second copy is thrown into the hopper to notify the computer of the action. When the signed card is returned, it replaces the second card. It will also act as a patron receipt when the document is finally returned. A duplicate is thrown into the hopper to notify the computer of a completed loan action. The next day, the item inventory supplement is updated accordingly.

When a loaned document becomes due, overdue slips are printed by the computer and sent to the patron in two-week intervals until the document is returned, the loan period is extended, or the document is converted to retention status.

When the document is returned, the signed card in the on-loan file is pulled, partially reproduced (call number and copy number), and reproduced fully. The signed card is returned to the patron. The fully reproduced card, or the original, is thrown in the hopper to update the item inventory file, and the partially reproduced card goes into the document to serve as the library activity card when the document is again needed.

7. Reproduction

If copies of a document are not available upon request, and if it is decided to reproduce the document from an available copy, the available copy is pulled by the circulation librarian. Its library activity card is punched with the following:

1. Number of additional copies needed,
2. Social security number of the patron,
3. Circulation librarian's initials, and
4. Proper transaction code (Figure 24).

The system chart showing actions involved for reproduction is Figure 36.

The document, with its card, is then given to the librarian in charge of reproduction activities who must decide whether to reproduce it in the library or send it out.

If the librarian decides to reproduce the document in the library, she simply reproduces the library activity card, throws one copy in the hopper to inform the computer of the document status, and gives the document with the other card to the reproduction operator (a position recommended, but not presently existing). When the document is reproduced, he returns it, the copies, and the library activity card to the librarian who requested the work. Each copy is assigned a copy number and is stamped with the library stamp. The call number part of the library activity card is reproduced twice for each new copy. One set, reflecting all copies, is thrown in the hopper, and the other is put in the documents. A new library activity card is put in the original document, which is ready for reshelving.

The circulation librarian transfers the social security number on the original library activity card to those library activity cards for the copies going out, adding also the transaction code to tell whether the copies are for loan or retention. The original card is thrown in the hopper, and the balance of the process is as discussed under Sending Out Documents.

If it is decided to send the original document outside the library for reproduction, the librarian writes out a reproduction order, sends the document and reproduction order to the Army reproduction unit, and sends the library activity card to the hopper. The document in reproduction is reflected

in the item inventory supplement for the next day. When reproduction is completed and copies are returned to the mail clerk, they are processed as if they were reproduced in the library.

8. Ordering (Re-ordering)

If the circulation librarian decides to reorder a document to obtain necessary copies (Figure 37), a card is punched with the following:

1. Call number of the document,
2. Circulation librarian's initials,
3. Number of copies needed,
4. Social security number of the patron requesting the document, and
5. Transaction code (Figure 24).

This card is given to the ordering typist who looks up the issuing agency, report, accession number, etc., in the bibliographic source catalog (by call number), types the order on a Flexowriter, and after checking it with the ordering librarian, sends it out. The paper tape created by the Flexowriter and the circulation card are then thrown in the hopper. The following day, the on-order list on the DIARY is updated, and a library activity card is punched to be given to the mail clerk for filing in the on-order card file.

When the order is received, the card is pulled from the on-order card file, reproduced, and thrown in the hopper. The reproduced card is put in the document, and the document is handled as if it were received from outside reproduction.

Ordering new documents is similar to the reordering procedure, except that the ordering typist receives library request forms instead of library activity cards. Before new documents are ordered, the ordering typist checks the on-order list in the DIARY to make sure that the requested document is not already on order. If not, the order is processed like a reorder, utilizing both the information on the library request form and the standard references in determining the issuing agency, etc.

If the ordering typist receives a library request form for an item already on order, the form is returned to the requesting librarian with a note about the previous order, including its date. The librarian who wanted the document pulls the library activity card from the on-order card file

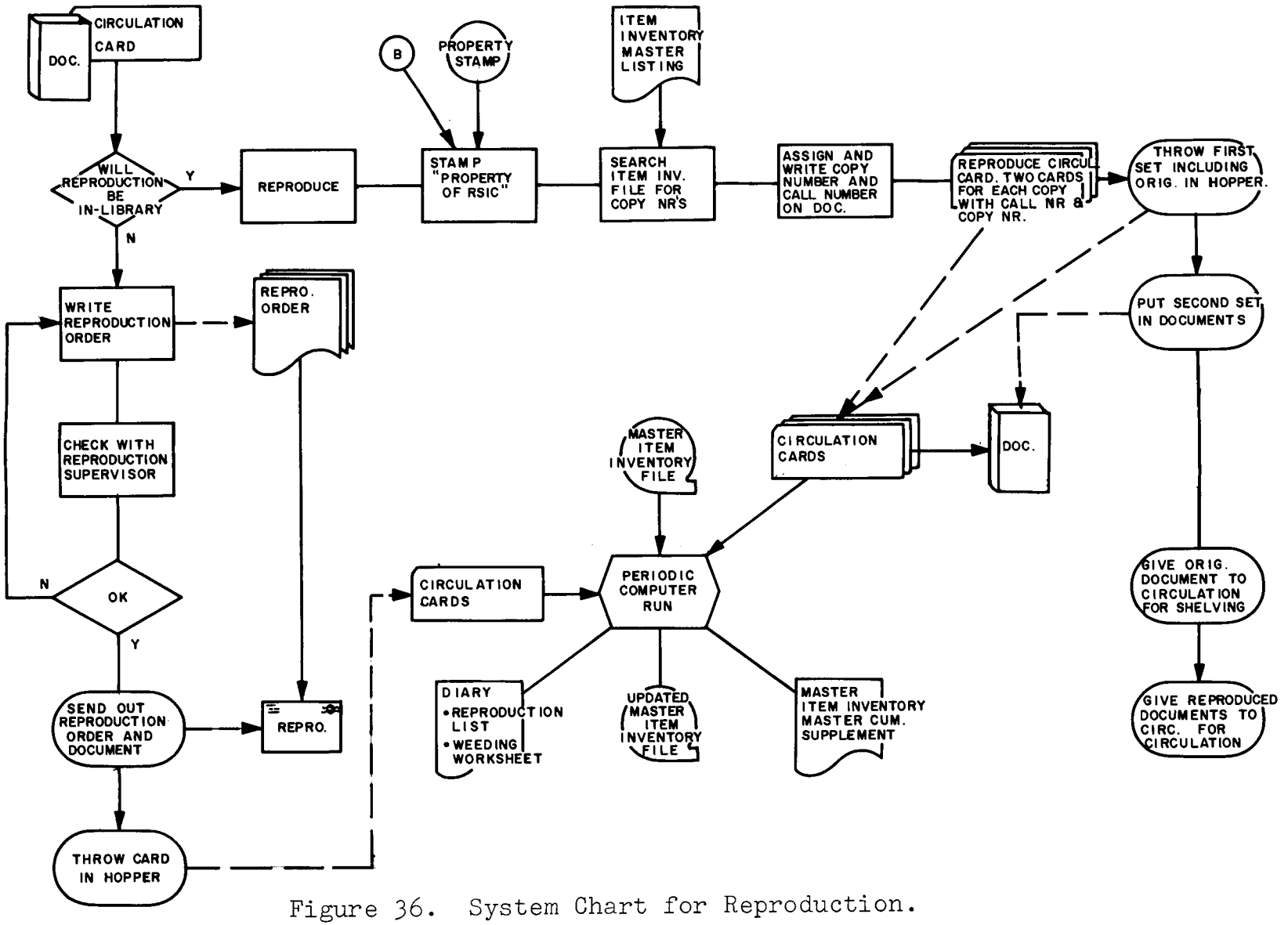


Figure 36. System Chart for Reproduction.

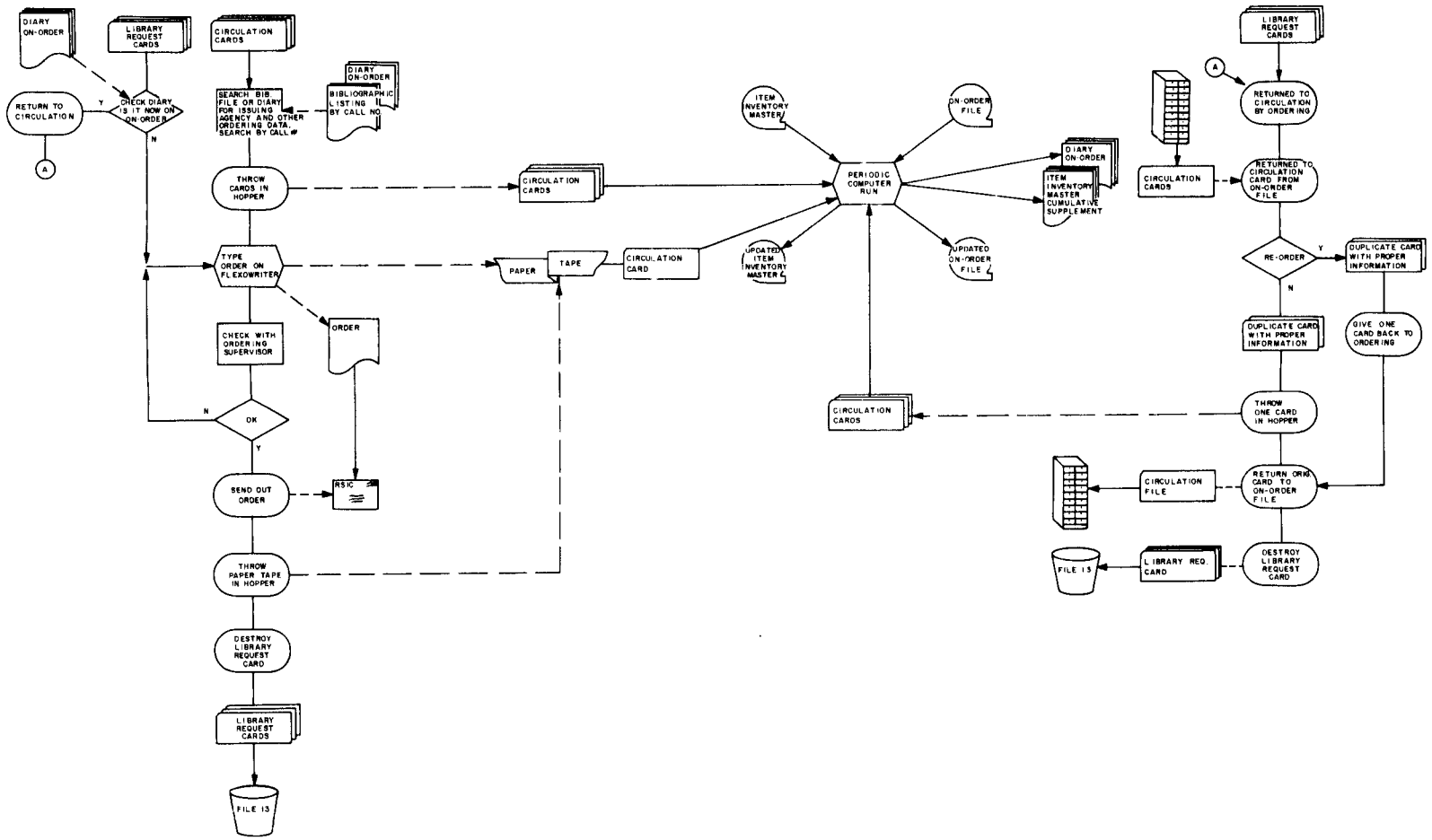


Figure 37. System Chart for Ordering.

at the incoming mail clerk's desk and determines whether to reorder the document or wait until the initial order arrives.

If reorder is decided upon, the library activity card is reproduced with the following additions:

1. Librarian's initials,
2. Patron's social security number,
3. Transaction code (Figure 24), and
4. Number of additional copies needed.

The original card is replaced in the on-order card file, and the duplicate is returned to the ordering typist to handle as a standard reorder.

If the librarian decides to wait until the previous order is received, the card is duplicated, with the same additional information, except that the transaction code will be a hold instead of a reorder. The original card is refiled in the on-order card file, and the reproduced card is thrown in the hopper. This will cause the DIARY to include the request for the document under its call number in the on-order list.

When the document arrives, it will be sent to reproduction, creating enough additional copies to fulfill all requests.

9. Reserve

If, after examining the item inventory file, the circulation librarian decides to recall (Figure 38) a copy of a document from igloo storage, the R-number of that copy is used to pull the library activity card from the reserve card file, which is maintained in R-number sequence. The card is reproduced, one copy going in the hopper and the other in the messenger's out-file. Periodically, the messenger will go to the igloo and pull documents by their R-numbers. On returning, he gives the documents and cards to the librarian whose initials are on the cards. Regular circulation procedures follow.

If a document is being sent to reserve, its R-number is assigned, written on the document, and punched on its library activity card. The card is then reproduced with the proper transaction code added. The original is filed in the reserve card file and the copy (with the transaction code) is thrown in the hopper, updating the item inventory file.

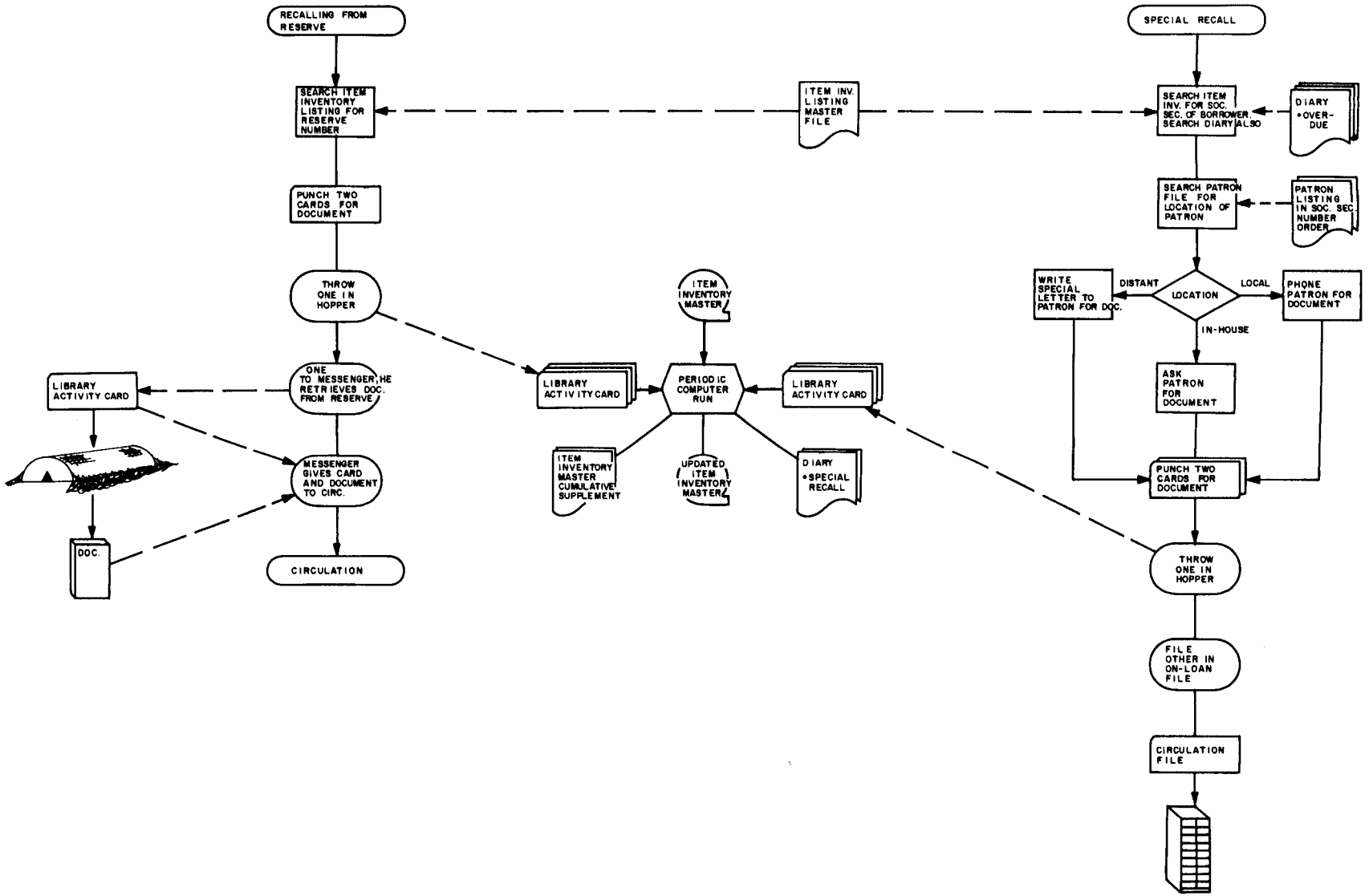


Figure 38. System Chart for Recalling from Reserve.

10. Special Recall

If the only way to obtain a document is through special recall, the overdue list in the DIARY is examined to see from which patron it would be best to recall the document. A special letter is sent or a phone call is made asking for the document, and a card is punched with the following:

1. Call number and copy number,
2. Initials of librarian requesting document,
3. Transaction code, and
4. Social security number of the patron requesting the document.

The card is reproduced, one copy being thrown in the hopper, and the other filed in the on-loan file in back of the regular card for the document. The next day, the call number of the document is entered on the special recall list in the DIARY.

When the document is returned, the added library activity card with the new borrower's social security number is used to loan the document to the new patron (see Sending Out Documents).

This procedure is only for special recall. Normally, every two weeks after a document becomes due, an overdue notice is automatically produced by the computer and sent to the patron, as previously described.

11. Cataloging

Immediately after receipt of a new title, the catalogers verify the security classification (if any), call number, and copy number transcribed by the receiving librarian. This is done by comparing data on the library activity card with the report number, publication date, and security classification of the document.

In addition, a duplicate but automated check was begun when the receiving clerk completed the library activity card for the document and placed a duplicate in the hopper.

If the copy and call numbers of the document were erroneously transcribed to the library activity card, the initial duplicate check is all that is affected. The error is corrected by cataloging personnel, and the automated transactions are sent to the computer. However, if a cataloger considers a document to be a possible duplicate, reference to the master source catalog and its supplements is made for quick duplicate checking.

In the first phase of descriptive cataloging, the cataloger first checks the document to see if catalog cards have been provided. If not, a catalog worksheet is completed and marked with references to all necessary information, as shown in Figure 28. If cards have been provided, they are classified and supplementary information is added to the cards themselves until they conform to the required information and security standards of RSIC.

The text of the document is next checked for an abstract or for abstract material. If an abstract is not present or is insufficient for RSIC and patron requirements, the library activity card is reproduced, one copy being put in the hopper and the other back in the document. The document is then screened by a descriptive cataloger for descriptive terms and material. The abstract and descriptive terms are marked on the provided catalog card or written down on the catalog worksheet, and the worksheet and/or catalog and library activity cards are stamped with the proper security level. If the title, descriptive terms, or abstract need security grading, the library activity card is again reproduced. One copy is thrown in the hopper, and the other is put back in the document. The document, catalog worksheet, and library activity cards are put in a grading file to await security grading.

Unclassified or already graded documents go to the Catalog Process Group, where the catalog worksheet, catalog cards, and abstracts in the actual documents are typed with a Flexowriter on a blank catalog worksheet. The paper tape, punched simultaneously as the form is completed, is converted to cards or tapes which go into the computer daily to add the document records to the bibliography file.

12. Internal Receiving

A chart of the internal receiving portion of the document system is shown as Figure 39.

It has been stated previously that all documents received by RSIC must go through the receiving area. These documents are received from the following channels:

1. Returned loans from patrons.
2. Completed work from the Army reproduction unit.
3. Filled orders or reorders.
4. Filled orders or reorders on an interlibrary loan basis.
5. Regular distribution (new documents received from various agencies without being ordered).

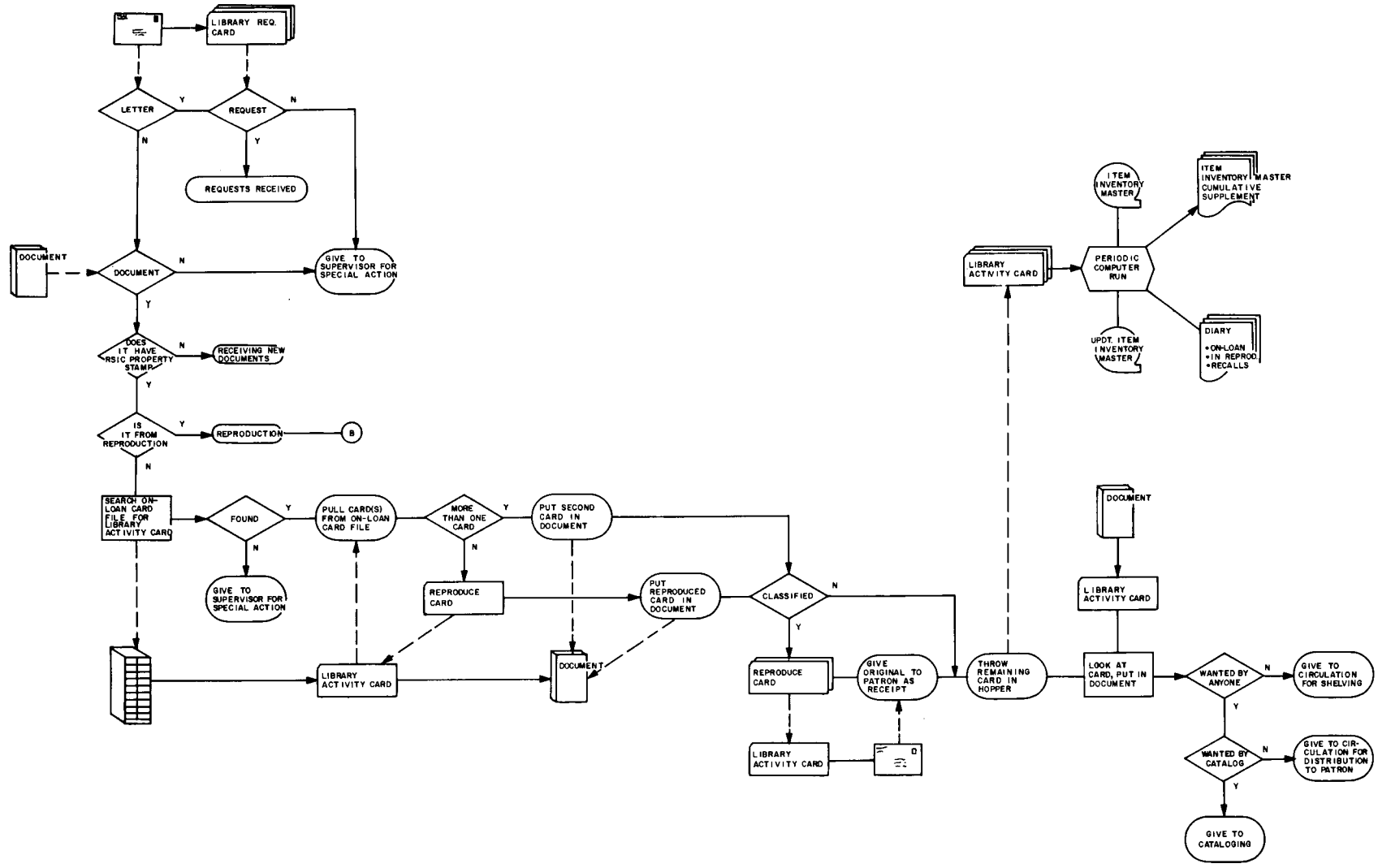


Figure 39. System Chart for Internal Receiving.

The mail clerk immediately separates orders, reorders, and documents sent from distribution lists from other documents received because none of these are to be stamped with the RSIC property stamp. These documents, which are never entered into the RSIC internal document system, are discussed under Receiving New Documents.

Those received documents that already have the RSIC property stamp either come from reproduction or are returned loans.

When a loaned document is returned, its library activity card is pulled from the on-loan card file, utilizing the call number and copy number on the document. If there is only one card for that copy in the on-loan card file, the document is not wanted by another patron. The call number and copy number portion of the card is reproduced, creating a new library activity card for the document. If there is a second card for the copy in the on-order file, that second card, with the social security number of the waiting patron, is put in the document to act as its new library activity card.

If the document is classified, the original card is again reproduced. The original card goes back to the patron as his receipt, and the reproduced card is thrown into the hopper to delete the loan from the item inventory file and the DIARY (if it was overdue). If the document is not classified, the original card is thrown in the hopper.

If the document is not wanted, it is ready for reshelving; if it is wanted for cataloging (for supplementary changes, errata, etc.), it is forwarded to the catalogers.

13. Receiving New Documents

A flow chart for the receipt of new documents is shown as Figure 40.

New documents may arrive as a result of an order or automatic distribution to RSIC from various government and corporate agencies.

On receipt of an ordered document, the library activity card is pulled from the on-order card file, and the call number is checked for accuracy. If the library activity card contains an incorrect call number, a correction card

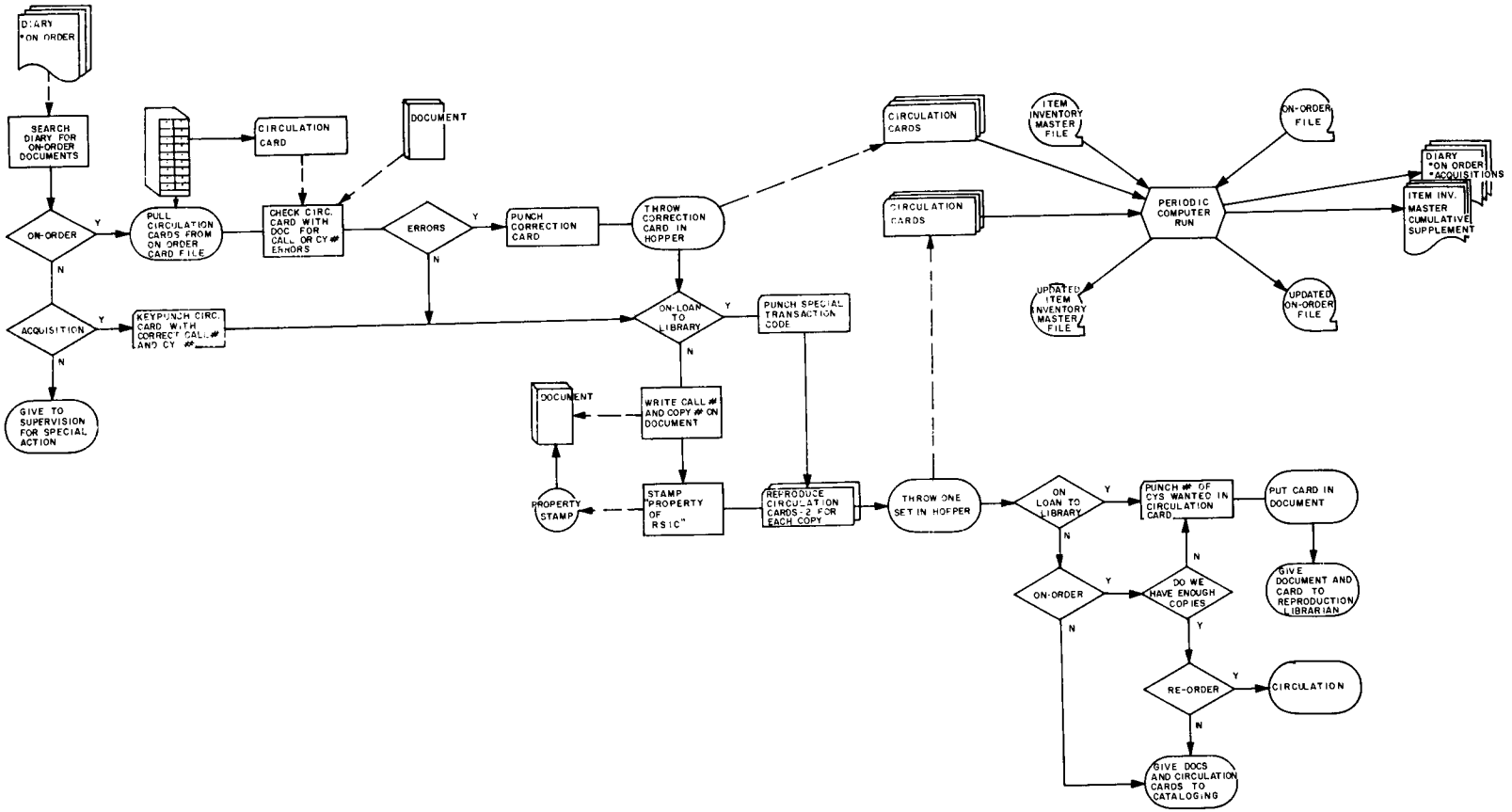


Figure 40. System Chart for Receipt of New Documents.

is punched with the following information:

1. Correct call number
2. Proper transaction code
3. Incorrect call number (in social security number field)

The correction card and the library activity card are then both thrown in the hopper and a new library activity card is keypunched with the correct call number of the document. If the document has been received on interlibrary loan, this information, as a transaction code and the date, is also punched on the card.

The document is assigned a copy number, and both the call number and copy number are written on the document. It is stamped with the RSIC property stamp. The library activity card is reproduced, one going into the hopper, the other with the document.

If the document is an interlibrary loan, it should be reproduced so that the original can be returned as soon as possible. Thus, if an inadequate number of copies arrive, the document is sent for reproduction. If the document is a reorder and has already been cataloged, it goes to the circulation area. If it is a new document not yet cataloged it goes to the cataloging area for duplicate checking, abstracting, etc.

Documents arriving from automatic distribution are handled in the same way, except that a library activity card must be punched and that the documents are sent to the cataloging area.

VI. IMPLEMENTATION PLAN

A. GENERAL CONSIDERATIONS

ALPHA I is a first-generation system tied to existing equipment and limited to readily attainable objectives. It will be extended and supplanted by further development work.

The "implementation" with which this section is concerned refers to the detailed design, programming, installation, and operation of ALPHA I as an end item.

The subsystems of ALPHA I have been designed together, but formed into self-contained modules. This approach provides flexibility and permits progressive implementation on a convenient basis geared to priority of needs and availability of programming manpower.

USAMICOM Computation Center analysts had commenced work on particular processes independently of the ALPHA I System design study. They and their work were coordinated and integrated in the over-all study effort as may be seen from the schedule that follows. Some processes (periodical reordering, book circulating) were installed in May and June, 1963, as independent applications. Others (periodical routing, book ordering, and receiving) were in advanced phases of development.

The whole periodicals area will be reviewed in March, 1964, with the aim of more closely integrating those processes with books and document control processes in accordance with the unified ALPHA concept. The particular operational applications cited will be modified and incorporated as subsystems of ALPHA I on the dates shown in the "operational by" column of the schedule.

B. DEFINITION OF MODULES

Detailed documentation sufficient to permit machine programming for each module has been excluded from this report. Such information is being released as addenda not reproduced for general circulation. The first addendum (book ordering and receiving) has been delivered, and programming is almost completed. The second addendum

(book cataloging) is being prepared. Each addendum will cover at least the following topics:

1. Charts depicting the run-to-run relationship of each automated module
2. Input and output formats and required file sequences
3. A written procedural narrative and/or logic diagram for each machine run, describing how required outputs are derived from prescribed inputs
4. Run frequencies
5. Disposition of outputs

C. SCHEDULE

The schedule for implementation of modules as subsystems of ALPHA I follows. Notes on present status are included.

Books Control Modules	Current Status	Operational by
Ordering and receiving	Programming and testing largely completed. In-process file being built.	15 Mar 64
Cataloging	Systems work 90% complete. Programmer addendum being created.	15 Mar 64
Circulation	AMICOM-designed system operating as autonomous module. Systems work 95% complete. With little external change will be absorbed into ALPHA System on date at right.	15 Jun 64
Current awareness	Systems work 90% complete.	15 Jun 64
Retrospective searching	Systems work 25% complete. Search algorithm developed.	15 Sep 64

	Current Status	Operational by
Documents Control Modules		
Ordering	Systems work 90% complete. Addenda not yet created.	1 Jun 64
Receiving	Same.	15 Nov 64
Cataloging	Same.	15 Nov 64
Circulation	Same.	15 Aug 64
Patron File Modules		
File creation and purification	Patron file creation and maintenance accomplished through AMICOM-designed program. File to be expanded to include interest profiles and to be absorbed by ALPHA on date at right.	1 Jun 64
Periodicals Control Modules		
Periodicals Reorder	AMICOM-designed module operational.	-
Periodical Routing	AMICOM-designed module operational.	-

APPROVAL

THE ALPHA SYSTEM

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. The highest classification has been determined to be UNCLASSIFIED.

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